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OUTLINES OF
LANDED ESTATES MANAGEMENT

TREATING OF

**THE VARIETIES OF LANDS ON THE ESTATE; PECULIARITIES OF
ITS FARMS; METHODS OF FARMING; THE SETTING-OUT OF
FARMS AND THEIR FIELDS; THE CONSTRUCTION OF
ROADS, FENCES, GATES, AND THE VARIOUS FARM
BUILDINGS; THE SEVERAL CLASSES OF WASTE
OR UNPRODUCTIVE LANDS; IRRIGATION;
DRAINAGE, PLANTATION, ETC. ETC.**

BY ROBERT SCOTT BURN

AUTHOR OF "OUTLINES OF MODERN FARMING," "THE LESSONS OF MY FARM,"
EDITOR OF "THE COMPLETE GRAZIER," ETC. ETC.

WITH NUMEROUS ILLUSTRATIONS

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PREFACE.

MUCH might be said by way of preface to the following treatise, so many-sided is the subject the details of which, described and illustrated more or less fully, occupy its pages. Little, however, requires to be said as to its importance; for that must be manifest, even to the most casual observer of the times and circumstances under which we live, which have brought about some marked changes in various departments of our national life; as, for example, the increasing population, the improved means of living, and the higher wages which many possess, the expenditure of which is exercised with a prodigality to which no parallel has ever before been presented in our social experience. As one of the results of this great change in the position and habits of living of large numbers of the population, who, in former times, looked upon what now are necessaries to them as luxuries, rarely, if ever, to be indulged in, and of a like increase in the means of the superior classes of society, there is a large and daily increasing demand for farm produce of all kinds. These and other obvious causes render it a matter of imperative moment that every means should be taken, not merely to increase the productive powers of soils already under a fair average style of culture, but also to improve or renovate those lands which, either by careless or wilful neglect or the lack of means on the part of their proprietors, have been suffered to fall into a condition of unremunerative culture, and are in danger of lapsing into a state closely approaching that of waste or unproductive lands. In both of these departments of practical farming there is a wide field for the outlay of capital, and the exercise of skill in adopting the best systems of working, for the display of that energy and practical and theoretical knowledge which have enabled the most advanced of our farmers to show what can be done in largely increasing the fertility of even ungenerous soils; improvements which ought to be extended, till they embrace all the farms of the kingdom. Nor is there a less imperative necessity to add to the food products required by our population by the reclamation and cultivation of lands which at the present moment are virtually waste, inasmuch as they yield nothing of value. Enough has been done in this direction to prove that vastly more is yet to be done; and all honour be to those who, like His Grace the Duke of Sutherland, are expending large sums in forming fertile fields out of wide tracts of useless lands. At the same time there are large areas of waste lands which are truly so, and which, if no other use be found for them, must remain so, inasmuch as by no known means of agricultural treatment can they ever be made so productive as to repay the cost of such endeavours.

We have said enough, then, to show the importance of the subjects of which our work proposes to treat. So numerous, however, are the details and so many are the points involved in each, that it is impossible, within the narrow limits of a volume like the present, to do more than give the merest outline of their leading features. Nevertheless, it is hoped it will convey to the reader a fair idea of at least the most important. The illustrations will, it is believed, tend to render the whole more explicit.

Such as it is, the volume is put forward by its author with a hope that, "outlines" though its pages be, it will serve not only to give the reader a knowledge of all the leading features of the subject, but impress him with a desire to study it in fuller detail in larger volumes.

ADDENDUM.

In page 39, *in fourth line from bottom, after the word* "acres" *add the words* "under turnip cultivation, or one fourth part of the whole."

LANDED ESTATES MANAGEMENT.

CHAPTER I.

LOCAL PECULIARITIES AND CHARACTERISTICS OF THE PROPERTY.

Local Peculiarities.

THAT much of the value of a landed estate depends upon what may be called its "local peculiarities" admits but of little or no doubt. In times more or less remote, but far removed in their aspects from the stirring ones we now live in, it would and did not matter so much as to where a property was placed. Comprising within itself all that the requirements of the population which dwelt upon and lived more or less directly by it demanded, it mattered very little, comparatively, whether the access to it was more or less easy. What was chiefly demanded was fair proximity to a market-town, and sometimes not even that, as buying and selling went on very much between the farmers of the estate, or by the traders, graziers, and butchers who came round at stated periods and bought up and drove away stock to the markets to be sold, or to the *grazing fields in* which they were to be fattened

There was at those times a species of "self-dependence," as we call it, existing on large landed estates, of which perhaps the only examples now to be met with are in certain parts of the Continent or in the colonies; although traces of it are still here and there to be met with in the more remote or isolated districts of this country. Matters, however, are vastly changed now, and we live in times and under habits and customs of business which are as different as well can be from that state of comparative isolation to which we have just alluded. We live fast now-a-days, in more ways than one; and business is no exception to the rule, if indeed it be not the most characteristic of all the modern ways of living in its "hot haste and hurrying speed"—in which every one is endeavouring to outrun, so to say, his neighbour in the race for wealth and position, and in which the weakest soon finds himself overpowered, either by the more agile or the less scrupulous. And although farming is perhaps the one business left now which has much of the quietness which our forefathers loved and, moreover, practised, if not with the dashing success of our times, at least with a degree of comfort and contentment which many amongst us, if the truth were known, really heartily envy; still it also has felt, and feels every day, more and more of the influences we have hinted at; and much of the quietness which does still characterise it arises, as it will likely always do, as much from its necessities and peculiarities connected with climate, soil, and crops—things which will take and have their time—as from any other cause.

Be all this as it may, and it is not lacking we believe, at least hope, in practical suggestiveness, the fact *remains that farming* in all its branches, both of production and sale, is a vastly more pushing business, and conducted with more energy, skill, and daring, than ever characterised it. Hence we find that some points, in former days not considered to be of great importance, are so now, and we find the local peculiarities of farms and estates connected with the means of transit, either to or from other localities more or less distant, points which demand and receive the greatest attention. For it is not only the point to be the first in—using this term as indicative of the farmer having the best produce—but at the market, so rapidly are transactions now gone through with.

A very large traffic indeed is now carried on throughout the country in taking not merely the produce of farms to markets, but conveying to farms the "thousand and one things" which the exigencies of modern farming require—the manure, the seeds, the implements, machines, &c., &c. The largest part of this traffic is conducted by the railway companies, as might be supposed, from the rapidity with which they carry goods great distances. The importance, therefore, of the farms of an estate having a ready means to avail themselves of railways will be obvious. Nor are the railway companies themselves at all unaware of the value of the farmers' business to them; so that many a little roadside station is put down, the chief if not sole purpose of which is to assist this business if possible. And perhaps no better idea can be obtained of one of the features of farming as now carried on than by noting, not merely the varied nature of its "products," but how gradually their extent influences the welfare of the "little station," and how this grows and grows till it is often raised to the dignity of a second if not a first-class *goods station.*

We have said that the railways are anxious to secure the farmers' trade; some of our readers may fancy this is very easy to do, as they have a monopoly of all the trade. Not so, however. In many districts of the kingdom the canals, which on their introduction were as great novelties as railways were on theirs, still keep open, and to good business purpose, and are able to compete strongly with even the superior rapidity of railway goods traffic. This arises from the cheapness of "water carriage" as compared with land; hence, as now stated, the large amount of business still carried on by canals, and hence, also, the value of the farms having easy communication with their loading stations, or with any part, indeed, of the canal. Much, also, of the traffic of estates is carried on between one town or village and another by "local carriers," a business of much greater extent than many might be disposed to believe; and it need scarcely be said that the cartage of the farm exterior to it is connected with the nearest market town. A good deal of traffic is also carried on along tidal rivers and with small seaport towns, in cases where the farms happen to be near those outlets.

The importance of having, therefore, not only short, but good road accommodation to the farms of the estate will be obvious from what we have said as to the number of outlets for their outgoing and incoming products and materials. Main roads or highways are almost universally well laid out, and, on the whole, well kept up; it is therefore to the "accommodation" and smaller roads that the attention of the proprietor of the estate requires to be directed. Many of the parish roads throughout the kingdom are kept in a condition which is far from satisfactory; with such there will always be difficulties over necessary alterations and repairs, and this not merely from the nature of the authorities who rule over them, but because, in many instances, of those being so constituted and divided that it is difficult to fix the responsibility in the right quarter; and all know how true it is that what is everybody's business is nobody's business. But the condition of the roads which belong to the estates themselves is not always so satisfactory as it should be; and it is only a wise policy on the part of proprietors to have the means of communication with districts exterior to their estates in as high a degree of completeness, both as to laying out and construction, as possible. (See remarks in another part of this work on the Construction of Roads.)

General Features or Characteristics of the Lands of the Estate.

The next point connected with estates which comes up for consideration is the general features or characteristics of the lands of which they are composed. As this includes the question of their value as agricultural lands, &c., the importance of the point will be observed by the student. This value is dependent upon a variety of circumstances, of which we propose briefly to treat in the present section.

At first sight the student might be apt to say, What can influence the value of the lands of an estate but the quality of the soil? But a very little consideration will suffice to show that it is not this which determines the value. A soil may be actually better in one district than another; but the soil of the poorer district can be made to bear crops and at a profit, while the other is devoted only to but a scanty and poor cultivation. *Locality, position of* the fields, climate, will influence the value of the lands of an estate. The mere position of a field makes a wonderful difference in the yield which it produces, for it may be exposed to a prevailing wind against which it is impossible to provide proper shelter, and against which crops cannot contend. This is the rule on this point, although like all other rules it has its exceptions, and some of these are very remarkable. We know of one farm with an exposure which almost invariably is found to be a bad one, yet the best land on this farm lies in this exposure. Again, as to locality, the lands may be situated near the sea, or to a range of hills against which the rain-clouds beat, producing a climate remarkable for its humidity and its lack of sun, so that crops are always late, and stock thrive but poorly if not provided with due shelter and be mainly house-fed. Or it may be dry, or subjected from a variety of causes to excessive droughts, which render the raising of crops, the keeping up of pastures, and the proper nourishment of stock, as difficult a matter in the one case as in the other. The importance, therefore, of attending to the "rainfall," the "temperature," and the "prevailing winds," and their effects, will be obvious. Climate, considered *per se*, too, has also its influence, and that a powerful one, so that poor soils bear better crops where this is favourable than richer ones where it is the reverse. The soil of a farm may be excellent, but the fields on which it lies are so characterised by their surface and position that a much larger expenditure for labour is demanded than in cases where the land is so situated, or lies so that it can be worked at the minimum of expense. The mere whim or caprice of the proprietor, indeed, may influence the value of his property. *It may be admirably* adapted for producing good timber, when the trees are judiciously planted; but trees are what he will not have. It may be made to pay best only under a certain kind of culture, but that is the one which he will not permit of. It may be wholly unfitted for stock rearing and breeding, but it is to this he devotes his cares; or while well adapted for one class of stock, that is the excluded class. These may seem to be exaggerations, but they are not always so, but sober matters of fact; and the agricultural history of our country could produce, we suspect, more than one example of the value of an estate being greatly reduced by little less than a whim. The fields may be so numerous and so small, may be encumbered with huge old-fashioned hedgerows, and these so thickly studded with trees, that not only is the productive power of the soil lessened, a large portion of it lost for cultural purposes, but their working is so far from economical that a farmer will hesitate before he gives a good rent for the farm, or to come up to that which is asked for it. Injudicious cultivation, by either robbing the land by allowing unskilful farmers to work it so as to deprive it of its manurial constituents, or by bringing up those which are bad from a worthless subsoil, may also reduce the value of the farm considerably. We have already said that the presence of "woods" in well-proportioned number, and judiciously disposed so as to give shelter to the fields without loss of their productive qualities, always to a greater or lesser extent raises the value of the lands of the estate, as the converse has the opposite effect; so also is that value influenced by the "water" characteristics of the lands. Water, it need scarcely be said, is an essential element on a farm. If it be scarce, *difficult as a rule to* be got, and in some parts only got at by great expense, and if small streams be few and in some parts do not exist, the value of the land is proportionately lessened. Whereas a farm well watered in every respect is sure to command a better price; and that will advance in proportion just as this is so well disposed in favourable and valuable parts that it can be used in place of steam as the motive power of the farm buildings, and in other localities be made available for irrigation and other purposes. Under such circumstances the farm assumes the position of a first-class one—other things being equal—which will bring the highest rent, and some estates are so favourably situated in these respects that their value is quite exceptional. A few other points remain to be noticed. If the land be as a rule flat, and the soil, climate, and locality good, the fields of the farm well laid as regards size and form, and judiciously sheltered, the farms will generally bring good rents, as the working of them as regards the use of either steam or horse-power will be reduced to a minimum; while the same may be said to be the case as regards the cartage to and from the buildings. The only objection to land as a rule too flat is the difficulty of getting sufficient "fall" for drainage, and, if water be abundant and other circumstances favourable for irrigation, an easy-enough flow for the water. But, with the exception of certain districts, large tracts of lands are generally distinguished by an undulating surface. On these, if the rise and fall of the land be not too great, and other circumstances being favourable, the farms possess such facilities for many operations that their value will, if it be not raised, certainly not be reduced. But there are some fields so very steep, and on the best farms, that not only is a peculiar mode *of ploughing the soil*—the "one way" furrow system

—necessary, but the cost of labour so great that the judicious farmer will look to this point as an element in his offer.

If the estate be selected in a part of the country where the chief portion of it is "hilly," much of the value of the hillside pasture farms will depend upon the way in which they have been treated and maintained. If the herbage be rank and coarse, or thin and scanty, through neglect in taking the proper steps to improve it; if the enclosing fences, where necessary, are not in good order; if in the low-lying parts the drainage has been either never done, or, if so, not done efficiently, so that it be wet and swampy; or if parts be boggy, the worst for sheep foot-rot; or if they have been allowed to become thoroughly infested with it, so as to deserve the epithet of "foot-rot sick land"—all these circumstances will be elements which the farmer will take into account in making his offer; and that offer will assuredly be less than it would had the circumstances been different. The same principle affecting the letting value of farms, and through them of course the general value of the estate, runs through all departments and classes of land or soil met with on it. If, in the case of moss-land and heath-land, reclamation has not been begun, or, having been begun, has been stopped from lack of capital or desire on the part of the proprietor; or if, in the case of lands skirting the margin of the sea, or a large river, tidal or otherwise, and those lands at a low level are embanked, and the embankments be out of repair; or if, in any of the farms, the buildings be in bad repair and defective in other respects,—all those circumstances will be considered by the *proposing* tenant in his offer, and will *tend, as a matter of course*, to make that offer less.

We have yet to name another point affecting the value of estates, so far as the proprietor and the tenants are concerned, and that is the "game" point. We confess to some fear in approaching *this* question—the *bête noire* of landlords and tenants alike. There has, moreover, been imported into the discussion of the question so much connected with what may be called party political considerations, and those mixed up with personalities on both sides which have no real connection with the subject, that it has got so beclouded with obscurities and difficulties that it is very difficult for those who desire to come to a right conclusion on the matter, and to help forward that just decision which will be fair to both landlord and tenant, to know what to make of all that is presented to him when he studies the subject. Where a farm is overrun with game, which beyond all doubt do a deal of damage to the crops, and thereby cause heavy loss to the farmer, it is difficult to come to any other conclusion but that his case is a very hard one, inasmuch as he cannot retain what he has unmistakably paid for, and which therefore is his, and that he has thus grave grounds of complaint. Even although compensation for admitted damage is given him, it is not always easy to get the admission made as to its amount; and in such cases compensation as a principle comes much under the category of fire insurances, in which it is invariably admitted that there are losses which no premium or compensation paid can ever make up—damages to business, loss of time, &c., &c., which no money can pay for. On the other hand, it is no less undoubtedly true that the proprietor's land is his own, and *that if he chooses to* keep part of it for game purposes *he has the right to do so*; while he can certainly retort upon the farmer that the risk of loss he may run is his own making, that he need not unless he pleases take the farm which he knows to carry with it what he (the farmer) calls the "game nuisance." While all this be true, it is at the same time clear that the landlord, in estimating the value of his estate, must take into account that that value must be influenced by the known and growing dislike which farmers have to take land upon an estate known to be a game-preserving one, more especially if the lands be nearly contiguous or run up close to the covers in which the game is preserved. While the landlord may choose to take this risk, the point ought not, if he be wise, overlooked by him that the people may have something to say on his moral obligation, and may raise the question whether any man is justified in keeping up a practice which is *said* to be—by those who ought, they think, to know, and whom they are therefore inclined to believe—the cause of a heavy loss of food or feeding stuffs, which loss ultimately is theirs. This, as it appears to us, is a fair statement of the chief points of this much vexed question; not all, we confess, but neither the scope of our work or our own desire, at least on the present occasion, admit of our going into others. What concerns us here is the fact that the game question is one which will influence, and is more and more influencing, the value of landed estates, considered from a farming point of view.

Closely connected with the game question, in the sense of being also a *bête noire* of farming discussion, are the questions of "leases" and the "tenant right," although both may perhaps be classed as one—we merely here allude to them as being likely in some, if not in many cases, to influence the value of the property, inasmuch as leases may contain so many objectionable and binding clauses, that the farmer cannot make up his mind to take a farm so tied up with difficulties, and restricting, as he thinks, so much his "rights" as a "tenant." It would be well, as beyond a doubt influencing closely the future of agriculture in this country, if all the "vexed questions" connected with it tending to bring landlord and tenant in collision with each other were settled, to enable them to work together thoroughly and harmoniously in the promotion of an art which affects them both so closely, and in the true welfare of which they must have the deepest interest.

The value of an estate, considered as mere property, which may be bought and sold apart altogether from its farming capabilities, which hitherto have alone claimed our attention, will be greatly raised if it contains valuable minerals, as iron and coal, of good quality, and so situated geologically as to be easily worked. Stone, slate, lime, and marl-pits are all also valuable sources of increased value being given to the estate. With these agriculturally, or, more correctly putting it, as a tenant, the farmer has nothing to do, the mineral rights especially being generally reserved by the proprietor; but in one sense their being on the estate tends to raise the land considered as farms also in value, for the materials above named are all useful in those, especially lime and marl, considered as manurial agents, while of course, with the exception of iron and slate, there is also great convenience in having supplies of them near at hand.

CHAPTER II.

THE AGRICULTURAL AND SPECIFIC CHARACTERISTICS OF THE ESTATE.

Soils and their Varieties.

THERE is nothing perhaps more striking in connection with what may be called the strictly agricultural features of landed estates, than the characteristics of their soils. At the first glance the uninitiated would suppose, from the position and general lay of any compact estate, that its soils would possess a uniformity at least in some degree similar throughout. While the tyro reads of "clay land farms" and "light land farms," he is apt to suppose that the characteristics of those soils are met with in equally marked and distinguished fashion on estates of greater or less extent. But the practical man knows differently; and although he is well aware that certain districts and localities are distinguished by the presence of certain classes of soils, such as those stated above, and others presently to be named; still he is equally well aware that although the general characteristic of the soil of the farm may be of a certain well-defined class, still there are remarkable varieties and differences of soil to be met with on the same farm. And this is not a feature of large farms only, for not seldom is it found that on a very small farm a wonderfully wide variety of soils is met with. Nay, further, that even in a field—and that sometimes of no *very great extent—this* peculiarity may be noticed. It may not be—and often, indeed, to the tyro, it is not—observable, so to say, on the surface; but it exists, and gives rise, indeed, to one of the not few puzzling characteristics of farming, which not seldom throws the calculations of the practical man, and the scientific agriculturist alike, somewhat ruthlessly aside, and introduces elements for which they had not at first made allowance.

These remarks, not altogether unnecessary to the beginner, will show that it is likely to be a fact met with in practice, that on landed estates there will be a variety of soils, greater or less according to their extent, and to the varying circumstances of locality, position, &c., &c. This variety in the character of soils is one of the causes which give rise to the changes in the results of agricultural experiments, so different from those which were expected when the experiments were at first made, which threw around the science of agriculture so much of that puzzling variety above alluded to which has given occasion not seldom and not very wisely to those popular expositions of the science, and upon which are founded opinions not very flattering to its status as compared with other sciences in which the same diversity of results is not met with. We shall see as we proceed how this is to be accounted for on thoroughly sound and scientific reasons; but it is deemed right to notice it briefly here, inasmuch as it is closely connected with the subject in hand.

So much could be written on this subject of soils—which is the very basis or foundation of all farming operations, even when considered from a theoretical or scientific view, to say nothing of that of the purely practical—*that the reader* will perceive that our remarks upon it *must be of a very* general and concise character, viewed wholly, moreover, under the practical aspect. Those who desire full information on loamy and clayey soils, the two most valuable for farming purposes, will find the rudimentary treatise on "Clay Lands and Loamy Soils," from the pen of Professor Donaldson, a valuable guide.*

The soil, considered from the farming point of view, is divisible into two parts: first, the soil *par excellence*, known as "land" by the farmers, and popularly as the "ground;" and, second, the subsoil upon which the soil rests. The soil or surface land—that which is scratched by the savage, dug by the gardener, and ploughed more or less deeply by the farmer—varies not only in the characteristics of its constituents, but in its thickness or depth. The subsoil may possess the same characteristics as the soil, or these may be totally different, belonging wholly to another class of geological formation; or it may be in some places like the soil, in others unlike; or it may possess some of the constituents, but not all, of those of the soil. It may in its mechanical features, so to call them, be precisely the same as the upper soil, light or heavy, or intermediate, as the case may be; or it may be wholly different, as where a sandy soil rests upon a subsoil of clay. It may be easily penetrated, or it may be wholly, at least practically, impenetrable by the instruments at the command of the farmer. The surface soil is not, therefore, any generally available and trustworthy guide to what the true character of the subsoil may be.

Soils may be classed on a system sufficiently close for all practical and scientific purposes, as follows: one may be taken as the outcome of the popular or general experience gained during a long course of years; the other upon a more scientific classification of their peculiarities and characteristics. The first of these systems might sufficiently meet the requirements of our work; but we shall add a few words on the second. One of those systems is based upon the crops which they are best adapted to; the other upon their general and specific characteristics. A soil is said popularly to be a "wheat soil" when it "is clay of an average quality, containing a certain proportion of silicates and alkalies freed from excess of moisture." Of this, as indeed of all the others to be named, a characteristic which is supposed always to exist is that the soil be well drained, judiciously manured, and well and carefully cultivated; that is, not only deeply stirred, but also kept as free as possible from weeds, &c., &c. A wheat soil is also generally classed, as it is considered on the whole to be, a "bean soil;" this requires to be "deep, strong, and yet a dry soil containing a certain portion of lime."

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* *London:* Crosby Lockwood & Co.

A "barley soil" may best be defined as "calcareous and limey;" it should be dry, or rather moderately moist and porous, and free, especially in the upper layers, as the habit of the plant is to send its rootlets in a lateral rather than in a deep vertical way. An "oat soil" is one in which vegetable matters are present in pretty large proportions, well decomposed, and richly manured; mineral constituents are an essential feature, however, in the soil. Soils suited for "forage crops," "green crops," or "root crops," the two former comprise the same classes of plants—those are the clovers, vetches, pease cut green, lucerne and sainfoin, which require "calcareous" soils; pease, if allowed to grow for seed, a soil much the same as that for *beans, but not* so strong or of such a mechanically *retentive nature.* Soils for root crops, such as turnips, light soils; rich easily worked loams are the best, stiff undrained ill-worked retentive clays the worst. Carrots, parsnips, and roots which require to descend vertically into the soil for a considerable distance, must have a light, porous, and deeply worked soil to suit this habit of growth. Mangel-wurzel, of the long variety, requires the same class of mechanical soil—so to say—deep and porous, but of a stiffer quality than required for turnips. Potatoes seem to do best, since the introduction of the disease, on a light, loamy soil, well worked and manured. We believe, however, it is a mistake to have it too richly manured, as not a few attribute much of the disease of the tubers to the over-manuring, to which for a succession of years they have been subjected.

Glancing now at the second system, we shall follow that very generally adopted, being that of a celebrated German scientist. It will be observed that one class is here named humous soils, but to our advanced readers it is scarcely necessary to say that the humous theory is not now received by scientific men, Liebig being the first to show its fallacies. The name is, however, still retained, although, in fact, it only indicates what may be called vegetable mould soils, such as peaty soils, or of fibrous vegetable remains of various plants. 1st class: "argillaceous" or "heavy clay lands," one sub-class without lime, and the other with it, but in the latter even the percentage of lime is extremely small. Generally this class may be said to be that in which there is more than one-half clay, with a very small admixture of lime. 2nd class: "loamy soils," some having lime, others not; but where it is present, it is not above 5 per cent. These soils have not more than 50 per *cent. nor less than* 30 of clay in their composition. 3rd class: "sandy loams," like the two others, some have and some have not lime in them, and if present, not above 5 per cent. The clay present does not exceed 30, nor is it less than 20 per cent. 4th class: "loamy sands," having not more than 20 nor less than 10 per cent. of clay, and those having lime, the percentage of it not less than 5 per cent. 5th class: "sandy soils," containing not more than 10 per cent. of clay, and if lime be present, not less than 5. 6th class: "marly soils." These contain not less than 5, nor more than 20 per cent. of lime. They are divided into four sub-classes—argillaceous, loamy, loamy sands, earthy loams, humous or vegetable. 7th class: "calcareous soils," containing above 20 per cent. of lime. There are seven sub-classes in this, five of them being named the same as the sub-classes in class 6, the two others being "sandy" and "pure," that is, being nearly altogether composed of lime with no clay. Class 8th: "humous" or "vegetable soils," which contain less than 5 per cent. of lime, and where clay is present not more than 20 per cent. Some are wholly without lime. In another part of this work remarks will be found on the methods adopted in working the most important of the various classes of soils.

As already stated, one peculiarity connected with soils is the variety of them met with, not merely within the limits of the district of a country, or that of an estate, or of its farms, but what is more remarkable, within the limits of some of those fields, and even those not often of great extent. This gives rise to a great diversity in the practical working of soils, and to the influence of manurial agents, &c., applied to them in the production of crops. The reader will find, under their appropriate chapters and headings, such remarks as we may consider necessary, or as space will admit of, on all the leading methods adopted in practice of working different classes of soils on farms.

Position or Locality and Sizes of the Farms—Small Farms v. *Large Farms.*

The positions and sizes of the farms of the estate will be regulated by various circumstances. The position is a term in which may be included their relation to one another, as well as to the main road which leads to the nearest market town, or to the nearest railway station; as well as to the home farm, which may be looked upon as the central point of the estate as being nearest the house or mansion. This will, therefore, be regulated very much by the way in which the subsidiary roads are laid out, and by the fact as to whether if improvements in these can be made so as to shorten distances, and thus save cartage and consequent expense, the landlord be willing to go to the expense of these. Another point which must not be lost sight of as affecting the question of alteration of the subsidiary roads, is that this alteration will influence the shape or form of the fields themselves. Strictly speaking, however, the question of the sizes or the dimensions or *extent* of the farms is one which comes up for consideration before that of the *form* of the fields of which they are composed, and to this, therefore, we first give consideration.

The sizes, or more properly speaking the extent, of the farms of an estate will depend upon certain considerations which involve so many points, all of which have given rise to discussions, not always conducted in the *most gentle of fashions*, so numerous and so diverse in character, that to do justice to them all would involve a space which we have not at command. We must therefore, however much inclined to the contrary, and convinced of their vital importance to the interests of the community at large, merely glance at them in the most general of terms. First is the question of "small as against large farms." Of late a very marked prominence has been given to this question, to which perhaps too much of political importance has been attached. Very much, therefore, of the decision of the landlord as regards the question will depend upon his opinions on this point. If these are in favour of small farms, and are strongly held, and he can afford to carry them out, the estate will naturally be cut up into a number of small-sized farms, and with a corresponding number of tenants, and *vice versâ.* Apart, however, altogether from questions of a purely personal nature, tinged as they may or may not be with political considerations, more or less marked, we deem it of importance to state very briefly what the truly practical points of the question at issue seem to us to be, so far as the paying considerations are concerned; for, as already hinted at, if a landlord be wealthy enough to carry out his notions, on whatever side these may be, and is careless of the point of paying, he may adopt any plan he pleases. This may appear, and is in fact a truism, but it carries certain important practical considerations with it, as we shall see as we proceed.

At the outset it is of course understood that the question involves really small farms as against those of large and of moderate extent—not as of the two latter only. By small farms is meant that class of which the extent of the largest is such that the work to be *done does not demand* the necessity to use a pair at least of horses; while of that of the smallest, horse labour has to be hired by the farmer whenever or if required, spade labour being often wholly used. Some may be so large as to require the employment of two pairs of horses —but this is decidedly the exception. In brief, small farms, as here meant, are those on which the labour is done, with little extraneous help of any kind, chiefly by the farmer and his family, and of which the best and most numerous examples are to be met with on the Continent, to which we are, by the upholders of the system, recommended to go in order to witness its great advantages. While those, however, are certainly worthy to be well observed, a close examiner will have no difficulty in soon seeing that they also make very clear the disadvantages of the system. In the first place, the class of men who farm small holdings of the kind indicated, are, as a rule, not educated. We do not say this in an invidious sense, or would infer that they are wholly ignorant. But their intellectual status is, to put the matter in its fairest way, not high. Now, to farm with intelligence under the present modern system of keen competition, and where all the newest improvements are required to be introduced in order to keep up with it, if intelligence of the highest order be not required—although we maintain that it is—still a certain degree of it considerably above the average level of that found amongst the class we write of is needed. While, therefore, we find the very highest degree of skill exercised which a life-long experience—and that obtained from a lengthened progenitorship, through which much has been handed down from generation to generation—can give, on the farming of the lands of such small holdings, we find that there has been little, in *many of them no* advance. The working of to-day is that of a long series of yesterdays; and the satisfaction yielded by it is such as to keep the mind of the present holder in a very easy frame of mind. There is, therefore, no desire evinced for any advance; if, indeed, the true statement of the fact be not, by the occupiers generally of small farms it is considered that none is at all necessary. "What we do has served the turn of our forefathers; are we wiser than they?" is a sentiment which operates much more strongly amongst men of the class than is generally supposed, and tends greatly to retard agricultural advance amongst its members.

But granting that all this were not so—as it is easy of proof to show that as a rule it is—if advance were desired, the means to make it are not possessed by the class now under consideration. Their very position precludes them from the chances of gaining large means; or, indeed, barely exceeding that necessary to enable them to go on. They live "from hand to mouth," as the saying is, and are therefore quite unable, even if they were willing, to purchase all the new appliances by which land and crops are cultivated and harvested, &c., and by which the richness and productiveness of the soil are increased. And where hiring, as in the case of machinery, is resorted to, it can only be done at an increased cost, which, although small for the service which it affords, is comparatively large when availed of in this way.

Hence it is the simple statement of a fact when we say that had the wonderful advance in farming, in the introduction into its practice of the host of mechanical appliances, and the not less numerous or effective supply of manurial agencies and feeding substances, *depen*ded upon the class of small farmers—or of those *who cultivate very* small holdings—that this introduction would not have been witnessed by the present generation, if indeed it had been so for many yet to come. And in saying this a vast deal connected with the material progress of the nation is concerned; so much, indeed, that this consideration alone is that which has convinced by far the greater majority of those who have fully considered the subject, that small farming is not calculated to advance the interests of the community.

But we have yet to notice another point connected with the question of small holdings, and it is one around which a good deal of sentiment has been thrown, giving it an interest which perhaps does not truly belong to it, and tending at all events to complicate somewhat unnecessarily a question which without anything of this kind is complicated enough already, and requires rather to be simplified than rendered difficult. This point is, that the small holdings if done away with would also do away with the yeoman class—our "nation's strength, our country's pride," and so forth—from which is drawn, so 'tis said, the finest of our soldiers, the best and bravest of our sailors. Be all this as it may—and a vast deal more has been said of a poetical and romantic character—while it may be true that from these farms such classes of men are drawn, the point is very questionable whether the advantages are such as are stated, and whether these, even if much greater than is ever claimed for them by their strongest advocates, are not more than counterbalanced by the other disadvantages of the system. The young men of such small holdings who are drafted off in the way described, and who are then presumably a drag on the home resources, must, before they reach the period of life at which *they are ready for* their "country's call," have to be brought up in some fashion or other. What this is may well be guessed at from the lives their fathers lived, and the hard unremitting toil which is their daily lot. From such little or no time can be reasonably expected to be spared to educate or in any great degree fit them for taking advantage of the best chances of the lives which they are supposed hereafter to lead. And it may be reasonably presumed that if brought up in towns, or if their parents were leading lives more calculated to yield them better "living," that the advantages flowing from such a condition of matters would be much greater than those obtained from the yeoman life, the romance of which we have heard more about than of its stern and truthful realities. We happen to know a little of what these are, and certainly have had ample opportunities to examine what manner of life is led by the peasant farmers of the Continent, to whom we are so often referred as affording the best examples of the system. But while ready and pleased to give our testimony to all the virtues of their lives, and to the hard industry by which these are supported—after a fashion—we are bound to say that as little from the point of view under consideration as from any of the other points we have adverted to, do we see that the system possesses any, or if any, very few of the economical advantages claimed for it. Nor in saying this do we overlook, or are in any way inclined to overlook, the painstaking care with which these Continental small farms are cultivated, a care which has made some parts—for example, Belgium—more like gardens than farms, and remarkable for the splendid crops which the farms bear; but we must also bear in mind that this excessive care is not that which is produced with us, no more than the—in many respects admirable—system on which the farms are cropped. Before the Continental results will be seen in this country, the Continental system in all its entirety must be introduced; and there are not a few difficulties—business, political, and financial—to be overcome before this can be done, if, indeed, our whole social system is not greatly antagonistic to any scheme for so doing. We have been thus particular in going into this subject, as it is one which has of late formed that of discussion in the legislature and "in other places," and in such a way so far removed, in what we may safely say the majority of instances, from the region of the practical, that many who may be contemplating the purchase of estates, or who may shortly be expected to "fall into them," may be apt to be over-influenced by what they may have read, and be thus induced to take steps which will in no way tend to the real improvement of their property. Far would we be from counselling any proprietor to turn away tenants who may have been for years, indeed all their lives, cultivating some small holding; but before deciding to cut up farms already of goodly extent into a series of small farms merely to gratify a notion or to carry out a "hobby," we should strongly advise him to consider well the proceeding before carrying it out; otherwise he may find some day that while he is convinced that it will then be for the true interest of his property to undo the work he has done, the mischief perpetrated by the experiment may, and almost certainly would, be found to be great, and not so easily undone. Land is not so readily deal with as to be made the medium of improvements, although based upon principles as to the morale of which no exception can be taken. That medium is too *costly, and under* the best and wisest of manage ment pays too trifling a percentage for outlay to admit of such.

Allotments.—This has been one of the subjects connected with the relationship between landlords or farmers and their labourers, which has been discussed in the one-sided style to which we have already referred in connection with other subjects; and about which it is exceedingly difficult to come to any conclusion, so diverse and contradictory are the opinions put forth by the advocates of both sides of the question.

That the possession of a small plot of land by the labourer, which he can cultivate in his leisure hours and raise vegetables and fruits useful in his family, seems, at first sight, a good thing. It is almost certain to have a tendency to give him tastes and habits which will keep him out of the beershop and public-house in the long nights of summer, and prompt him to devote those of winter to the amusement of his family in various ways, or to avail himself of the many sources of rational amusement, or instruction in useful branches of knowledge, opened up to him in almost every village in the kingdom. Yet it appears that there is the other side to the question; what of the labour and the fatigue which it involves, caused by the working of the plot of land? This, the opponents of the system say, is but another way of robbing the master of strength which ought to be husbanded for his exclusive use. Granting that the argument be true, and that the labourer has no right to use his spare time, which is his own, as he pleases, might not the question be fairly put—Is a man less likely to do his master's work after labouring a few hours the night before in his plot of ground, fatigued —*if he be fatigued*—with healthy toil, than if he went *to his work fatigued* and worn out with the worst of all fatigue, that occasioned by untimely debauchery in a tavern?

The "Home Farm."

To each estate of any extent there is, as a rule, throughout this country, a portion of the land set aside for the purposes of being cultivated under what may be called the "direct control" of the proprietor. This, of course, is a merely nominal designation or arrangement, the farm so laid out being under the management of the head bailiff. At the same time, there are many noblemen and landed proprietors, who take such a thorough interest in agricultural operations, that their control of the "HOME FARM," as this part of the estate is called, is something more than nominal. We could name, as many of our readers could also do, many landed proprietors, and of high social rank too, who, as scientific and practical agriculturists, are second to none in the country.

The "home farm" being, then, either under the one or other of the systems above named, is naturally looked up to by the tenants as the "model farm," so to say, of the estate, in which the most advanced practice, both in field and fold, is to be seen, and from which the best lessons, both of a scientific and practical kind, are to be derived. But while this in reality should be so, or at all events pretty nearly realised, the home farm will fail in what we may call its educational uses, if it be distinguished in all departments by appliances of the most costly kind, and by management of the most lavish character, equally regardless of the cost they may respectively incur.

It will only succeed if, on the contrary, while every thing is of the best arrangement and construction nothing shall be extravagant, beyond the necessities of a first-rate managed farm, and the whole be so conducted with a scrupulous regard to prudent management and economical expenditure that it can be proved, with all this, to be a paying concern. Nay, one of its objects should be to show that it does pay for this very reason, because everything is of the best, and used and managed in the best style. It should not be a "model farm" in the popular sense of the term, a toy-place, with expensive arrangements, &c., &c.; but a model farm in the sense of showing how the maximum of results can be obtained from its working, with the minimum cost in the outlay for this. To this end certain points must be attended to, and a certain system of working be adopted; what the chief of those are we shall now very briefly point out.

As the evidences of careful management are those to which observation is first attracted, everything about the farm, alike in its outer parts, as fields, roads, and in the inner portion, as buildings, should be kept in the highest degree of order. In the former department, all the roads should be in good repair, the enclosing fences if quickset well trimmed, if of hurdles evenly and perpendicularly set, if of stone or brick well pointed; and in all, the gates must be well hung. In the buildings the utmost order and cleanliness must be displayed; nothing out, but everything in its proper place. For, however faulty some farmers may be in their own practice, they have a keen-enough eye to the faults of others, and are by no means sparing in their criticisms. The stock must also show in themselves, and in everything about them, that they are well attended to. In brief, *in everything that* can be seen, examined, and criticised openly, there must be such a condition of matters existent that neither the proprietor nor his manager can have any fear as to the result of such criticism.

At the same time, those points which are occult, so to say, are none the less to be looked carefully after, for on many of them will depend much of the fact whether the home farm is to be a paying one or not; and that, as we have before said, is the point which is to be arrived at, not less for the interests of the proprietor than for the influence which the farm will exert as an educational part of the estate. To this end a most rigid and accurate set of account books should be kept, showing every working detail of the farm. An accurate plan of each field should also be had, showing the position of drains with their outfalls, position of fences and gates, and another detailing the mode of cropping, and the part of the rotation under which at the stated intervals it comes to be placed.

As to the rotation and system of cropping to be adopted, a good deal of consideration must be given, so that the crops decided on for each field will be those best adapted for the nature of the soil, locality, and climate. We shall in another chapter point out the different rotations adopted, stating here only that they may, under the improved systems of farming now introduced, be much modified in detail, indeed may, as they often now are, be wholly dispensed with.

The live-stock of the home farm, also, should in its choice and selection show that the manager has a thorough knowledge, not only of the points of the different animals, but that they are selected with judgment as suited to the quality of the soil, its cropping size, locality, and climate. And one point should be carefully *avoided—the* purchase of show stock only for the purposes of the farm. The stock should be good, but only of the kind or class which would be purchased by the tenants of the estate. Show stock or first-class prize animals may be kept for the purpose of improving the breed; but the first object of the home farm ought to be to show how by first-class management the *ordinary* appliances, means, and stock of the general tenants of the estate can be so used that the improvement will be great; at least, so decided as to influence those who may be indifferent to such matters.

While all extra expenses and what may be called somewhat roughly, yet graphically enough, "hobby schemes" should be strictly excluded from the home farm, it should be the care of the proprietor and his manager to make it the means of showing to the best advantage the newest proposals in practical agriculture, and the machinery or appliances by which these are to be carried out. If any part of the farm is adapted to illustrate such modes of irrigation as may be applicable to certain parts of the estate, then it will be advisable to have those parts of the home farm laid out under the different systems applicable to different qualities of land and peculiarities of soil. So also with town sewage irrigation, and indeed with the wide range of new things which the restless spirit of agricultural improvement and innovation is for ever introducing. But all must be done—and this principle can scarcely be too often repeated, as it cannot be too rigidly enforced—in the most thoroughly practical way possible, by which the largest amount of work is to be done with the least possible expenditure in doing it. This, we believe, is the true principle upon which a home or model farm should be conducted. It is the easiest possible thing to *make an effective show* with large means at command, but the truest genius and the highest practical skill are shown by giving great results at little cost, and with the fewest possible means and appliances, and those of moderate price and within the easy attainment of the majority of the practical men who are tenants on the estate. The costly experiments, which may often be termed the mere eccentricities of extravagance, are not always those which are best calculated to further the progress of practical agriculture, which may be defined to be an art which produces with the minimum of means the maximum of results. It will be in exemplifying this that the home farm will best fulfil its mission.

"*Led Farms.*"

Where in cases a farmer has taken land which he finds too small in extent to suit his ideas, or to employ to the fullest advantage such extra capital as he may be possessed of, or where, for reasons of ambition or otherwise, he desires to be the farmer of many "broad acres," and some farm which may happen to be to let at the time within near proximity to or a not very inconvenient distance from his own farm, and takes the farm which is to let, he occupying the house at one when he farms the land of the other, the second farm he thus takes is generally called a "LED FARM." (The "Farm House" on the farm not occupied by the farmer being either let by him to a friend or some stranger, who is often very glad to get the advantage of such a house in the country, or the house may be occupied by an overseer or manager who "looks after things, and carries out the plans of the master.")

There are various opinions as to the propriety of having "led *farms*" *to* form part of the policy of the management of an estate. Where the two farms are in close contiguity, the management amounts, in point of fact, to little more than this—that the farmer simply holds a larger farm now than before, and the two may be worked together as easily as one; but where the distance between the two farms is considerable the matter assumes another aspect, and some are inclined to object strongly to the arrangement on the ground that the farmer cannot, under such circumstances, pay equal attention to both; that if he takes a preference, in course of time, to one—a natural thing enough to be done by a man—he may in so far neglect the other, not wishing to do so, but still this would be the likely result under such circumstances. Again, if the farms are widely separated, an overseer for the "led farm" has to be appointed, and however able he may be and anxious to do his duty, it is not in the nature of things that he can or will take the same interest in the management of the farm and the carrying out of the plans of the master as the master himself. It seems to be admitted on all sides that if any business requires more than another the carrying out of the old adage, "a master's eyes are worth a hundred pair of hands," that business is farming, and that it can only be thoroughly successful where it is thoroughly carried out. If this be so, then it would seem to involve the conclusion that the "led farm" system is not one to be adopted on an estate if that farm be at a considerable distance from that which the farmer occupies himself. Much, of course, will depend upon the farmer himself; but here, again, another old adage comes in, with its warning if not its lesson, that "it is better not to trust to chance in matters of importance."

Different Kinds of Farming.

There have been various classifications of the kinds of farming employed—such as Clay Land Farming, Light Land Farming, &c.—but these have had reference chiefly, or been based upon the quality of the soils. A classification in accordance with the localities of the farm has been adopted. This is set forth in the "Book of Farm Buildings,"* by Henry Stephens, F.R.S.E., author of the "Book of the Farm," and Robert Scott Burn, and may here be reproduced, as we naturally deem it about the most practical classification yet adopted. It has indeed been adopted by other writers without acknowledgment of their source of information.

The first, and most simply carried on, is that of "Pastoral," which is wholly confined to hilly or mountainous parts of the estate, if these happen to be upon it. Pastoral farming, however, is divisible into two classes: the first, in which high and low lands unite, sheep being grazed in the upper and cattle in the lower ranges; the second being that of high ground alone or nearly wholly so, in which case sheep alone are reared. A third class, however, may be added, although it is decidedly exceptional, where the low lands finish off the hilly ones—the low lands skirting a river which may flow through a valley at the foot of the hills. In this case a small extent of land is devoted to arable culture, the produce being chiefly that fitted for the peculiar wants of the farm; oats and bere or big—a coarser kind of barley—being the only cereals grown, the climate being generally in such situations anything but congenial to higher classes of produce. A few turnips are grown. Hay on pastoral farms—and that, as may be conceived, not of the finest quality—is the principal crop grown for the use of the stock. Pastoral farms are usually of great extent (see a succeeding paragraph), ranging from 1,000 up to 3,000 acres, and the rate per acre averages usually very low.

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* *Blackwood & Sons,* Edinburgh and London.

As forming the very antipodes of a pastoral farm district, the second class of farming, the "Carse," is named here. It is wholly devoted to arable culture, and being alluvial soil, generally of the richest character—lying on the margin of a river flowing through an extensive valley—is devoted to the raising of cereals of all classes, live-stock not being kept, as pasture grasses are not suitable to the soils of such farms generally. The extent of such farms averages 200 acres, and the rate per acre is, as may be conceived, high.

The third class of farm is the "Suburbial"—"Suburban"—or, as the name implies, being in the vicinity of a large place, "Town Farming." This is devoted entirely to arable culture, and (as stated in another paragraph) is very much allied in some localities—as, for example, in those near London, Manchester, Liverpool, Birmingham, and other densely populated places—to the ordinary style of dairy farming; also to that of market gardening. The increased demands of the population of our large towns—consequent upon the advance of wages amongst working men, and the general increase of wealth amongst all classes—for farm produce, in the way of milk, butter, cheese, poultry, and pigs, is fast making this kind of farming one of the most important practised. In other cases root crops are largely grown, as turnips and potatoes, and fodder crops, as hay and straw; all of which, as may be supposed, are in great demand. The extent of these farms averages 300 acres, and the rental is usually very high, and is, in fact, daily rising, from the causes above named. (See the special work in this series on "Suburban Farming," by Professor Donaldson.)

As the Carse farming is the opposite of the Pastoral farming, so the fourth kind of farming now to be noticed may be said to be the opposite of the last kind : this is the "Common Farming," which is localised at a distance from towns. These farms are devoted to the raising of grain and green or root crops, and the grazing of cattle purchased to be fattened for market; or to arable culture for the raising of grain chiefly, according to soil or locality. This kind of farming is so named inasmuch as it is that which is chiefly met with in the kingdom, being capable of any degree of expansion or of change of rotation. The farms vary in extent from a minimum of 400 up to that of 1,500 acres; the former may be taken as the average. The rental is generally moderate.

The fifth kind of farming is a very important one, and is growing daily more so, in view of the increase of town populations, &c., namely, "Dairy Farming." The best dairy farms are those which are well supplied with good rich old pasture grasses, and are situated near a large town. They are wholly devoted to the production of milk, butter, and cheese, pigs and poultry; the arable culture being devoted to the raising of food for the cows. Dairy farms vary much in extent, and the rental is usually very high in favourable districts. In one sense, dairy farming may be classed as a part of town or suburban farming, to which we have already alluded.

The sixth and last class of farm to be noticed is the "*Mixed Husbandry Farm.*" This, as its name denotes, combines all the peculiarities of other kinds of farming. It raises all varieties of cereal, green or root, and forage crops; cultivates grasses, artificial and natural, for haymaking and for pasture. It breeds, rears, and fattens all varieties of live-stock; and thus combining all, its extent is naturally anything but limited, so that a farm of this kind is rarely less than 500, while it may, and often does, extend to 1,500 acres. Happily independent of the peculiarities of locality and climate, save those of course of the first-class of farming we have named, it can be carried on in almost any place, and hence is the most popular, so to say, of all the classes of farming named. It possesses one great advantage over all others; any one season cannot be so peculiar as to damage all the crops of the same farm. Some are sure to be saved where there is such a variety to fall back upon; and even should all be damaged, a most unlikely thing, some will be so slightly so as rapidly to recover. But it will be a rare thing if weather should be such as to prejudice all the varied crops of a farm of this kind; its peculiar feature, in brief, may be illustrated by the negative of the old-fashioned saying, that "all one's eggs are *not* carried in the same basket."

Waste Lands.

The above may be taken as a very practical, and what we may be permitted to call a philosophical, view of the farms of the United Kingdom as carried out under different localities, soils, and climate, constituting as they do the regular systems. But there are others which scarcely come under any classification, yet, being met with in various parts of the country, and constituting a very large extent comparatively of its surface, must not be passed over. They cannot indeed be so, for although up to a comparatively recent period they were not deemed worthy of any practical attention, still under the improved system of modern farming, and the exigencies of an increased and ever increasing population, their cultivation forms now part of the regular work of all well-managed estates upon which they happen to be situated. They present, moreover, many inducements for the "improver" to take them in hand, inasmuch as some of them when well-managed afford a very fair return for the labour and money expended upon them. These lands may be classed as "marsh" lands—bogs—"lands situated on the margin of the sea, of tidal or inland rivers," and "heath," or what may come under the general term of, and indeed are known as, "waste" or "common land." The whole of these classes are popularly known and considered to be "waste lands," of which a vast deal has been both written and said of late years, not always with a great amount of practical knowledge of the subject.

At the outset it may be stated that a great deal of popular misconception exists on the subject of what is called the "reclamation of waste lands." Some are so far good that they will pay for their reclamation, but in many cases they would not do so; and no practical farmer who knows his business would "take them as a gift," if the taking depended upon the condition that they were to be reclaimed. It is different, however, with some of the classes we have named, and to this we have already alluded. Some marsh land—although it is not always correctly designated, being more due to its undrained condition than to its being a true marsh in the ordinary acceptation of the term—although at first sight it seems to be hopelessly worthless, containing as it does many of the elements of fertility, is well worthy of being reclaimed at even considerable expense. The same may be said of some tracts of the heathy land above named, and some of the light peaty mosses with proper treatment produce crops which pay the cost of their reclamation. Thousands of acres now forming land of which few would guess their origin, and which are laid out into farms producing crops not far below the average—in some cases up to it—were not many years ago wide tracts of sterile, miserable-looking stuff, which was not worth the asking for. The tracts of land reclaimed from tidal rivers are especially rich, and some of them will bear crop after crop without the addition of manure. "Warped" land is peculiarly valuable; and again under the judicious application of liquid manure land has been raised from what was not worth half-a-crown the acre to a condition of productivenes which brings in an equivalent to nearly forty pounds for this extent. All this shows what can be done by judicious management, and by a careful looking after the capabilities of the soil, its locality, and climate. We shall see as we proceed what has been and can be done in this way.

CHAPTER III.

LAYING OUT AND DISTRIBUTION OF VARIOUS PARTS OF THE PROPERTY—SIZES AND FORM OF FIELDS—RELATION OF FIELDS TO ROADS AND BUILDINGS—DIFFERENT KINDS OF LANDS, ARABLE, PASTURE, ETC.

Extent of Farms, and Area and Shape or Forms of their Fields, best adapted for Economical Working.

WE have in the preceding chapter glanced at the vexed question of small or large farms; but apart from all theories correctly based, and all fancies or hobbies as incorrectly so, the question after all as to the size of farms upon an estate must be decided by certain circumstances. If "small holdings," for one reason or another, be decided upon as forming part of the system upon which the estate is to be laid out, the minimum size or extent should be that capable of keeping in full, constant, and steady paying—or what ought to be paying—work, two horses and a "plough," or "two-horse cart team." If the land is cultivated upon the four-course system (see remarks on Rotation of Crops) in which a fourth part of the land is devoted to turnips, sixty acres is the extent usually calculated as requiring a pair of horses—a team being allowed for every fifteen acres being the rough-and-ready rule. But to provide for contingencies and to get the most out of the horses without *overworking* them, seventy acres may be *allowed, although,* as we have already said, it is better to cultivate a small area thoroughly than a larger one only indifferently or not so well. This, of course, it need not be said, puts wholly out of court that system of small holdings cultivated by spade and manual labour only, which is the *beau idéal* of so many writers and platform orators, and to some of the errors of which we have already alluded. To holdings, therefore, of which we have indicated the minimum, the term "Small Farms" would perhaps be the better, as it is, indeed, the most accurate one.

But while thus giving the minimum extent of "small farms," we are by no means disposed to recommend that they should form to any great extent a part of the system upon which the estate is to be laid out. If the most is desired to be made out of it, and the land of all the farms worked up to the highest point of efficiency, there should be no small farms at all upon it. This is, however, be it remembered, the purely agricultural point of view of the question, not the popular sentimental one. A farm will not only pay its tenant better, but the land will be better worked, if it be of such an extent as will justify him in expending not merely a fair but a liberal amount of yearly capital upon its working, and that that working be such as to demand and necessitate the employment of the best and newest appliances of all kinds; and the making a thorough business of it, attending to it and it alone, as the means of making his livelihood. Farms of this kind, of course, vary greatly in extent, that being regulated mainly by the chance of gaining fairly good tenants, who may be relied upon as the "regular payers." The smallest may be put down as starting at 140 to 150 acres, or a "two-plough team farm;" while the largest may start at 500 acres, going up to a maximum of from 1,200 to 1,500 acres, although

1,000 acres is a very large farm and requires a very large amount of capital to work it—£10 to £12 an acre being the usual amount allowed for to work a farm properly. It is few, comparatively, who are prepared to invest so much money in the working of a farm, and as a rule even men of capital—unless they have the ambition and the means to be of the "upper ten" of agriculture—prefer to have farms of moderately large extent, say from 500 to 750 or 600 to 800 acres. And it certainly is the safer method to farm a small farm thoroughly well up to the limit of its capacity, than to indulge in the pleasure or the vanity of having a "very large farm" and not to cultivate it so well.

The size or extent of the farms, and the number of each of similar or nearly similar extent being decided on, the next point to be considered is their shape or form, and the extent of the fields. Estates in this country are so old, having been handed down from generation to generation, that their local features, so to call them, have remained unchanged for similar periods. The form or shape of the fields and the sizes of these have in like manner undergone little or no change; so little that the oldest man in the parish can generally remember, with unfailing accuracy, that a certain corner or bend in a certain field, which might have been the scene of some exploit in the days of his youth, remains to-day to "greet his dimmed and aged eyes" precisely as it was then. Some have wondered at the peculiar forms of fields, and have expressed surprise that they should not have been made of a more regular form in the earlier stages of the history of the estate, for they have all the look of antiquity, the fences being "hoary grey with eld;" but they are ignorant of the way in which those *strange and* often fantastic forms took rise. The desire to "add field to field" is one as old as man himself nearly, and as some got richer and others got poorer the fields of the latter were bought up and added to those of the former; and in those early days little was thought of economy of labour involved in the shape of the fields to be worked, and things indeed were very much taken as they were left or handed over to them, so that odd-shaped parts were allowed to remain as they were, all the more readily that the new naturally fitted into the old. Then again, litigations, long and stern, might be held over a particular bend or corner to decide as to whether the land enclosed within it belonged to one proprietor or another, till the lapse of years, when the law's long delay had at length decided the point, and had left it one of comparatively small importance whether the fence should be left as it was or changed into some more seemly form. Again, a certain degree of "superstitious veneration," if the term can be so applied here, has prevented the form of fields from being changed, the son not caring to undo what he knew his father had so long looked upon. All these and other considerations tended for long to retain the size and the form of fields through a long course of years; and when at last the light of science dawned upon men's minds, and it was plain that something was to be gained by having different forms, it sometimes was not so easy to effect the change as some might be disposed to think.

We have prepared a few illustrations to explain, in a more graphic form than is obtainable by mere description alone, the principles we have pointed out as influencing practice in the laying out of fields, the fencing of these off, and also their relation to the roads, *as well as the* best method of laying out these. Of course, the reader will understand that the illustrations to follow are of a very general nature—mere diagrams, in fact, to explain principles, not drawings to scale to give details. Many of them are also somewhat exaggerated in form and outline, but this is done purposely more clearly to explain the point under consideration; and it in some cases is caused unavoidably by the smallness of the scale—a curved line on a small scale being obviously more "pronounced," as the French say, than when it is drawn on a larger scale, in which the curves occupying a large surface look less curved. These explanations we deem necessary, in order to account for certain features and modes of treatment which might otherwise seem peculiar and uncalled for. It is expected, however, that the diagrams thus prepared will serve the practical purpose we have in view in offering them to the attention of the reader.

As regards the shape or form of fields, the most practically useful is the rectangle or parallelogram. As fencing forms an important and a very costly item in farm-work, and is essential where good cultivation and field arrangement are desiderated, it is important to reduce its cost as much as possible. Now a square field, as in Fig. 1, while it takes the minimum of enclosing fence, gives the maximum of enclosed space. But we have already shown that there is a length of furrow in the case of fields under arable culture which is found to be the most economically cultivated—this varying from say 240 to 250 yards in the heaviest worked, and from 270 to 280 yards in moderately easy worked soil. Now furrows of this length adjusted to square fields would give too small an area for the highest degree of economical working to be obtained in farms of *any extent* cultivated on the mixed husbandry system, or where any considerable number of cattle was kept. Larger fields, varying from twenty-five up to thirty-five acres, would therefore be better; and to keep the same length of furrow this would necessarily throw the field into a form longer than broad, thus giving the rectangular shape or parallelogram, as in Fig. 2.

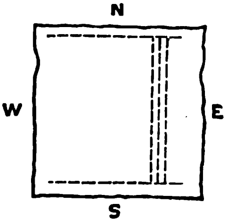

Fig. 1.

Where the estates are to be remodelled thoroughly, the best shape for the fields is undoubtedly that in which the outlines are right or straight-lined, and not zig-zag, bent in here and coming out there—for it is with such right-lined or straight fences or outlines that the work of cultivation can best be carried on. But this is not so easily attainable in many estates, and scarcely attainable at all, or, if so, only at great trouble and frequently greater cost, where the estate "marches," as the technical phrase is, with that of another proprietor, or, in other words, where two estates belonging to different landlords are contiguous one to another; proprietors as a rule not being much inclined to "give and take" in this way, although it would be to their manifest advantage to do so, as making their farms more practically valuable.

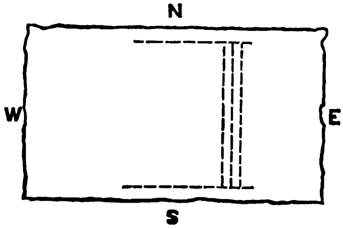

Fig. 2.

Few are aware of the loss of time caused by the working *of fields in which* the fields have their fences all "outs l ins," as shown in an exaggerated way, *a b*, in Fig. 17. e horses have great difficulty in working up to the ces, in finishing off the headlands, while there is in ne instances almost an impossibility to do so, not ing into account the waste of land at certain very kwardly shaped parts from the impossibility there is working them at all. See as an illustration of this

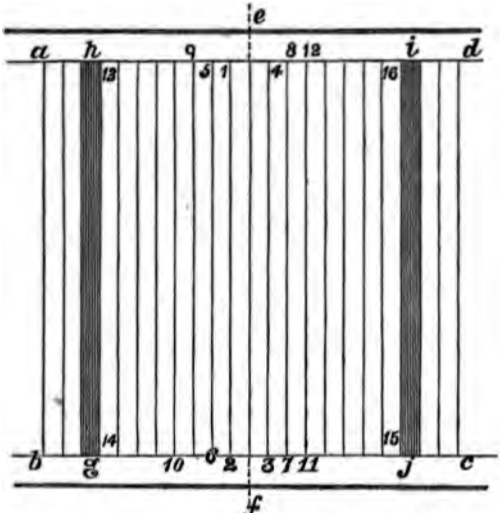

Fig. 3.

diagram in Fig. 5, giving the position of fields of s awkward character. Although this diagram is of rse exaggerated, it scarcely misrepresents the actual ition of fields in relation to each other to be seen in ny counties. The time lost above referred to in work- short furrows, and the advantage therefore in laying fields so that their shape will give not only the best *th of furrow, but that* the length will be uniform, may be illustrated in the diagram in Fig. 3. Suppose *a b c d* to be part of a field to be ploughed in the ordinary way: the surface is divided into a series of compartments called "stetches" or "ridges," the dividing points between any two contiguous compartments being the furrows, as *g h*, *i j*.* The exterior or surface of the "stetches," as *g h i j*, is rounded generally off, the highest point being at the crown or central point, *e f*, of the stetch or ridge, the lowest at the furrows *h g*, *i j*. The central furrow-slice, *e f*, is made up of the two first slices lying right and left of the line *e f;* and all the remaining furrow-slices on one side of *e f* lie inclined to the right, the other to the left side. To obtain this arrangement the following working and turning at the headlands is necessitated. The central furrow-slice at *e f* is formed by the plough going down say in the direction of furrow 4 to 3, so throwing over its furrow-slice in the direction of left to right; on arriving at point 3, the plough is turned round along the headland, *c b*, to the point 2, and moving up to point 1, turns the furrow-slice from left to right; the central furrow-slice is thus formed of two slices, each lying in opposite directions. On arriving at point 1, the plough is turned sharp round and moved along the headland, *a d*, towards *d*, till point 8 is reached, and the plough there adjusted so that it moves down the field to point 11; arriving there, it is turned round, moved along the headland, *c b*, till point 6 is arrived at; it then is made to plough up from this to point 5; from point 5 it goes to point 12 down to point 11, along the headland, *c b*, to point 10; from this the plough goes to 9, and so on till the last lines—13, 14, 15, and 16—are reached, which complete the breadth of the stetch. It will thus be perceived that the plough is made to work round, so to say, the central line, *e f*, alternately along the headlands, *a d*, *b c;* and each length along the headland increases as each furrow increases in distance from *e f*. The shorter, therefore, the furrows, as 1, 2, the more frequent the turnings at their ends, and the more frequent the journeys made along the headlands; hence the time lost in ploughing a field with short furrows.

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* Those, for long before under-drainage was introduced, formed the only drains by which the land was cleared from water, and the *distance between* which varied with the soil and climate, thus accounting *in one way for* the various breadths of stetches found in various *counties.*

The position of the furrows in relation to the form of the field, or the direction in which they should run, is a point of considerable importance, although it is often overlooked; the great object being to give as much exposure to the sun and light to the furrow soil and the crops which it carries as possible, this will be best secured by running the furrows from south to north, as in Figs. 1 and 2. Circumstances, chiefly brought into existence by marked peculiarities in the "lay" of the land, will, however, modify this rule materially. Thus the surface of the field may have a decided slope in a direction other than from south to north, or *vice versâ;* and as the object in land with surfaces of this kind is to get the water to drain off from the surface with moderate rapidity—dependent in some measure upon the average drought, or otherwise, of the locality—an important point to be considered in the culture of green crops—the direction of the furrows will be changed accordingly. Thus in Fig. 4, the "trend," or "lay" of the land or field surface is from west to east, as shown by the sectional diagram *a b;* the furrows will run therefore in this direction. Or the field may present several inclined surfaces differing in relation to one another; or it may be like a small hill or tortoise or round-backed; in all cases such as these some judgment and care will have to be exercised in the laying of the furrows, so that not only shall they be placed so as to receive the greatest amount of sunlight, but so as to facilitate drainage. Further, in hot climates, and districts where there is much hot, sunny weather, and also frequently some droughts, this rule of the furrows running north and south may—and often is obliged to—be reversed or modified. In some cases the "inclination" of the surface of the field will be so "pronounced" that the usual way of working the furrows and "stetches" or "ridges"—which has been already described—will not be admissible, and the ordinary form of plough will have to be discarded for the "one-way" or "turn-wrest" plough, by which all the furrow-slices are made to lie in one direction over the whole field.

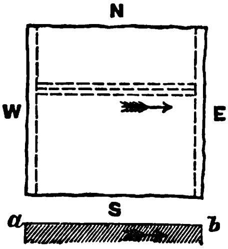


Fig. 4.

In all cases where the proprietor can deal as he chooses with his own farms, that is where none of them or their fields "march" with those of another proprietor or other proprietors, he will find it to his advantage to pull down the old crooked fences and substitute for them others with straight lines. This is all the more necessary in cases where the power of steam is likely to be employed in the cultivation of the fields. In fact, steam cultivation cannot be worked to anything like its full paying capabilities with small fields having zig-zag fences; its best powers, in every sense, have only fair play given to them where the fields are large and unencumbered with fences of any kind. The size or extent of the fields of the different farms will also vary according to circumstances. It is found, as already stated, that in practice where horse-power is employed to work the lands the best length of a furrow is about 250 yards; this length does not keep them too long a time working till they have a breathing space at the end of the "bout." This may be said to regulate the size of the fields, but other circumstances come into operation modifying this. The length of the furrows should, however, never be made too short, as a great deal of time is lost in turning the plough at the headlands; with the furrow of the length above named, 250 yards, the loss from this cause alone in a working day of ten hours is no less than one-fifth, no small consideration in the "wage bill" of the ploughing of a farm during one season. These facts go to show the fallacy of the system which some advocate that the sizes of the fields should be in proportion always to the size of the farm. No doubt this rule does hold to a certain extent, and in many instances, where the fields of a very large farm are of course larger than those on a very small one. Taking an average—if that can indeed be taken where so many modifying circumstances come into play, and these not always easily estimated or foreseen—the sizes of fields should vary from ten up to twenty-five and forty acres, the smallest being adapted for the lowest, the largest for farms of the largest class, according to the rule we have already, in another part of this chapter, given. A good deal depends upon the style or mode of cultivation carried out—some kinds of cropping requiring larger fields to be worked with profit than others; as, for example, turnip and root crops *generally. The length* of furrow we have stated as the best for horse labour may be varied according to circumstances—a longer furrow being obviously open in cases where the soil is light, or shorter where it is very heavy. And the position of the furrows should be considered with relation to the roads leading from the field to the farm steading; there being one, the most obviously convenient on inspection, by which direct communication along the ridges—from which produce, and to which manure are carted—can be obtained with the least outlay of labour in gaining access to the field. The fields while, as we have stated, being regulated in size very much according to the cropping or rotation under which they are cultivated, should also be placed in relation to that rotation, so that the labour at different periods of working a given part may be so concentrated upon it that the cost may be reduced to a minimum.

Suburban farms, again, generally being devoted to a variety of crops, and some of them not being of great extent, this variety demands a number of fields, which cannot, of course, be large, but the size of each of which must depend upon the nature of the crop cultivated, and will vary from fields from five up to ten and twelve acres; and the more closely the style of farming approaches that of market gardening, as it often does, but on a larger scale, the more varied, in number and size, the fields will be. Many suburban farms are, again, devoted to the raising of produce for farmers of the same class, who, being nearer the towns, and for other obvious reasons, do not deal largely in arable culture, but devote themselves more to the actual production of dairy and other produce, for which there is a great demand in the towns close to which they are *situated, and* which being of a very perishable nature *cannot stand much* transit or long keeping.

The farm on the hillside parts of the estate, if such there be, can obviously be made of almost any extent, 1,500 to 2,000 acres being no unusual size, while the fields will only be limited in extent by the shelter necessary to be obtained from the enclosing fences and rails. To lands, again, on a sea margin, the same remarks will apply, the limit in both cases being, in fact, the requirements of the farmer; and these will be regulated naturally by the amount of capital he can devote to the purchase of his farming stock, for which those farms are alone or chiefly used; the only limit which should be considered in relation to the size of the fields being the number and position of the fences, which are to act as shelter-spots in severe weather for the stock. But even this will, in process of time, be greatly modified, when the new system of erecting special shelter-sheds is more extended. On purely sheep-growing farms in hill pastures the shelter required is obtained through the medium of "stells," or stone enclosures, placed at intervals over the hillsides, and the fields being divided in such farms almost universally by stone dykes or walls, a good deal of shelter is also provided by them, and the position of these is regulated by circumstances of locality and climate.

In the laying out of the fields of a farm, the true principle on which to proceed is the adaptation of their dimensions and their mode of enclosure to the peculiar rotation practised on the farm; there being, so to say, a particular size best adapted for a certain kind of cultivation. This principle, although thoroughly sound, being based upon scientific deductions as well as those of practice, is not always to be carried out, as may be judged from what has been already said; and some proprietors would grudge having to go to the expense of altering old fields, pulling up old fences and replacing them with new. But in cases where an estate is being put under a new system, and that a scientific one, the principle should always be acted upon. On mixed husbandry farms distinct enclosures for the fields are essential, the number of the enclosures corresponding with the style and consequent number of changes in the rotation. Space does not permit us to go further into this very interesting subject, on which so much can be said; we must therefore content ourselves by merely indicating the principle in general terms. As an example: a farm cultivated on the four-course system, say of 400 acres in extent, will have four principal or grand divisions of 100 acres each. These divisions will be appropriated each to its particular share or part in the rotation; but the student will perceive that each of those would alone be unmanageable to cultivate with the economy due to the principles we have elsewhere explained, although on "grand farms," as the French would say, of great extent, some of the fields are very large. Each division is, therefore, divided again into smaller sub-divisions or

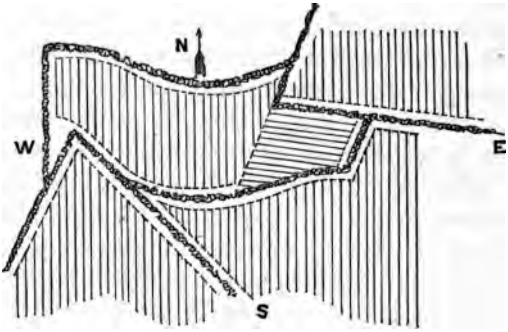


Fig. 5.

fields, each of which may bear different crops; but, of course, all coming under the class of rotation, or more than one field devoted to the same crop, but cultivated differently, according as varieties in the soil, &c., would indicate, or the farmer would desire to follow out. The greater the variety, say, of green and forage crops, the better, and for the reasons we have elsewhere named. The sizes of these sub-divisions, or smaller fields, would vary according to local and other circumstances, but four fields of 25 acres each would exhaust the area of the division; some would, however, prefer the area of each to be smaller, thus making, perhaps, six out of the 100. The sizes will of course vary with the aggregate acreage of the farm, being obviously smaller in a farm of 100 acres than in one of 400; but this is not carried strictly out in proportion, otherwise it would as obviously be the case that the fields on a small farm, of which there are many in the country, would be far too small; indeed, it may be broadly stated that even on the smallest farm the fields should not be less, if under arable culture, than 8 to 10 acres each; if under pasture, some may be smaller than this, to suit convenience of working, shelter, &c., &c. The shape best adapted for working is a rectangle or parallelogram, of which the length should be, if possible, 250 yards or thereby, to suit the horses working, for reasons already stated; the breadth, of course, being then regulated by the area of the field. But even on farms of large extent, and indeed on all farms where the fields are fairly proportioned to the aggregate acreage, a few small fields or paddocks should always be provided, and these as near the farm buildings as possible, so that calves, young colts, &c., &c., may be turned out for an occasional run, or used for sick, convalescent, or weakly stock, and for many other purposes which will suggest themselves to the reader. In lands reclaimed from the sea, the fields devoted to arable culture will have their dimensions or size regulated, as in other cases, according to the kind of cropping. (See remarks on the Cropping of Lands of this kind in Chap. V.)

As regards the shape of the field, we have in Figs. 1, 2, and 3, and corresponding letter-press, indicated some of the leading circumstances influencing this as well as their size. In the case of pasture fields and those devoted to meadow land for hay, as the system of working is wholly different and necessitates no ploughing, their size may vary according to the circumstances of the farm. As a rule, it will be found advisable, as we have elsewhere recommended, to have the pasture fields not too large in size, so that a change of "bite" or of the quality and kind of grass may be obtained from time to time—a matter of great importance in feeding of stock; and as regards the shape of the pasture and meadow fields, although from the above it would appear that the same necessity to have straight-lined boundaries does not exist, it should be remembered that as these pasture and meadow fields are mixed up, so to say, with those under the plough, and lie contiguous to them, the fences of the one will determine the lines of those of the other. Further, in the case of meadow land, it should be remembered that in the use of mowing machines, very rapidly becoming almost universal, the economical working of these is greatly facilitated by the shape of the fields and their boundary lines. Wide extents of level surfaces, with few or no sharp curves or bends near the fences, are the circumstances under which the *mowing* machine and the hay-tedding machine best *display their* advantages. The points connected with the distribution of the fields in the laying-out of the farm as a whole, will be found briefly discussed in the next chapter.

All these, and other circumstances which only the intelligent manager or agent can take cognizance of, he being on the spot, and being acquainted with all the circumstances of each particular case, go to modify the arrangements by which the sizes of farms are regulated, and prevent also any fixed rule or set of rules being laid down which would be applicable to all cases.

There are, however, one or two circumstances affecting the sizes and indeed the forms of fields of farms which require to be yet noticed. The first of these we shall draw attention to is the positions of the roads and the directions these assume with relation to other parts of the farms or of the estate. We have, at the commencement of the present chapter, alluded to the influence of these upon the size and form of the fields, and have there pointed out the fact that much of the way in which it is to be modified will depend upon the ability or willingness of the proprietor regarding them; for although it may appear obvious at first sight that the diversion or alteration of the direction of a road would materially improve the shape of a field, and make its cultivation a more easy and profitable matter, still it by no means follows that that diversion is one which is of necessity easy to be made, either as regards its cost or its relationship to other roads connected with it, or to the homestead or steading of the farm. But in many cases, by judicious arrangement, a road, for example, which divides two small fields may be altogether done away with by throwing the two fields into one, and forming one good field out of two poor fields, adding also to the extent of land by that taken up by the road and its usually wide-bottomed and huge fences; while at the same time nothing is lost so far as the change of the road is concerned, inasmuch as the distance from one point to another may be shorter, or not longer at all events, than before. Other improvements of a like character may be made, amply repaying the cost of time and labour devoted to their diversion; and the intelligent agent will always be on the look-out to see how these can be made in the easiest and cheapest way. Where such improvements are available, there should be no hesitation in carrying them out, for the advantages gained by doing so are in every way worthy of being obtained. Thus, in Fig. 6, which is a diagram illustrating one of the points above alluded to, the road A B which divided the two fields *e c g h*, *f d i j*, was of no real service, as it ended at points equidistant from the only points to which *vehicles, &c.,* desired to go, namely, from *a* to *b*, or from *f to c, or vice versâ;* and not only so, but the space

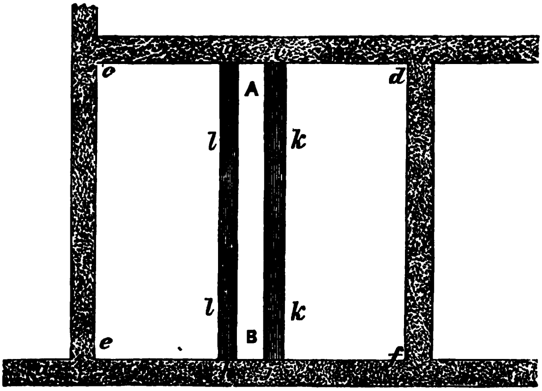


Fig. 6.

taken up by the road A B, and its bounding broad-bottomed fences, *g h*, *i j*, and outside of these the ditches *l l*, *k k*, was so much ground lost, and a nuisance besides. The change effected, as illustrated in Fig. 7, by doing away with the central road A B in Fig. 6, gave a large additional space of land, as *e f g h*, and made two small unserviceable fields into one good-sized field, *a b c d*, Fig. 7, excellently adapted for the working of root crops.

Badly laid-out roads may also, as stated above, be very considerably improved by no great expense being laid out upon them. Thus in Fig. 8, the crooked road, *a b c d*, which gives an exceedingly awkward form or shape of headland, *b c*, at the termination of the furrows, and thus adds to the labour and cost of ploughing, may be improved very much by cutting off the banks between the points *a* and *d* by the straight line *a f*, which makes the road right lined and at right angles *to the line of furrows*, making the headland straight, as

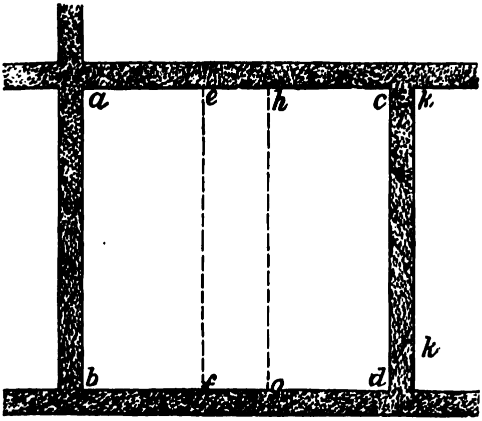


Fig. 7.

c d, in Fig. 9. If, as in Fig. 8, the road at the point *g g′* begins to go up to and in the direction of *g g′*, the improved or new cutting may be made in the direction of the line *h i*. But although all straight roads, as *a b*, Fig. 9, are the most economical for traffic, still if they run diagonally to the line of furrow of an arable field, a vicious arrangement is introduced which should, if possible, be avoided. What this will be, will be particularly noticed in the next chapter, when treating on the subject of Fences.

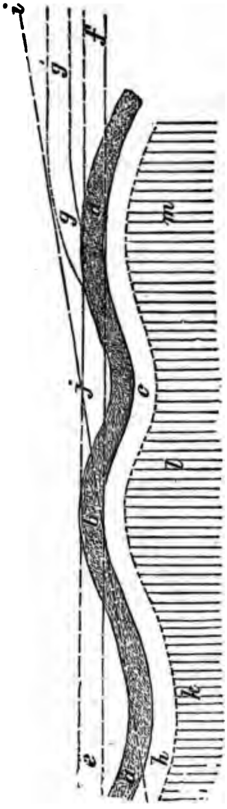


Fig. 8.

Again, although roads may not be diverted or done away with, still they may, in many instances, be improved, much also to the improvement of the fields which they partly enclose, even if that improvement went no further than the doing away with such wide-bottomed and high-topped fences as those to which we have already alluded, and which in so many parts of England especially bound their sides. These fences not only take up much valuable land space, but do, perhaps, even greater damage to the crops which grow close to them by shading these from the sunlight, and by withdrawing much of the nourishment which they would otherwise derive from the soil, that being taken up by the profuse and often large growth of underwood, shrubs, and even small trees with which the sides of those huge fences are covered and their tops crowned. The accumulation also of generations of decayed vegetable matter, which has practically added to the size of these fences, affords a supply of most excellent mould, which, judiciously applied to garden or other land, would go far to repay the cost of removal.

So much for the subsidiary roads as affecting the positions and shapes of fields. We have now to advert to another point influencing the positions of these, namely, their relation to the central homestead or steading of the farm. Manure having to be carted to, and produce from the fields to the steading, it is obviously a point of considerable importance that this should be so placed in relation to the fields generally that the labour of carting should be reduced to a minimum. This would naturally lead, one would suppose, to the central part of the farm being chosen as the site of its steading and buildings, and this is what the majority of writers have recommended. But while as a general principle it is correct, and can scarcely be controverted, still there will be circumstances connected with some estates, such as the varying quality of the land, which will modify this rule. There are some farms we know, especially on reclaimed land, where the fields on one side of them are of such a quality of soil, and have to be *cropped or altered* in such a way, that very little

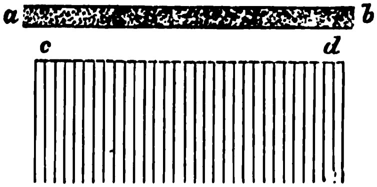


Fig. 9.

carting indeed is required to be done in connection with them. Here the rule above alluded to would be quite out of place, and the farm buildings, to minimise the cost of carting, would require to be on that side of the farm on which the fields lay bearing the greatest amount of produce to be carted to, and of manure carted from, the buildings. And yet, obvious as this rule is, there are instances where it is often overlooked, and the buildings are placed close to that side of the farm to and from which carting is seldom required. Such considerations show how difficult in the setting out of estates it is to lay down one rule which must or can be made applicable to all cases. The relation of fields to plantations, or, perhaps, it is better to put it the converse way, the relation of plantations and shelter belts of trees to fields, will be found treated of under the heading of *Plantations*, in Chapter V.

If the estate be very large, and comprises within its bounds a great variety of different classes of lands and soils—such as lowland and hillside pastures, lands adapted for arable culture, under one or other of the heads of farming specified in Chapters II. and V., "commons land," or heath land, marsh lands, bogs, and land by the margin of the sea, or of inland or tidal rivers—it is obvious that their distribution over the surface of the estate will be decided alone by natural circumstances, and will not be amenable to special rules or principles. This, however, in some cases, may be taken with a reservation, as, for example, in the case of a farm of which, from its favourable position, the largest part is under arable culture, or say the mixed husbandry system; this may be bordered at a certain *part by common* or heath land, or by peaty or boggy, *ven marshy* land. In this case, in laying out the property, should those qualities of land be deemed likely to pay, if reclaimed, a certain area of each may be given to the farm, with some agreement as to the area to be reclaimed within a given time. In such cases, where new farm buildings have to be erected, it will be necessary to consider whether these should not be so placed as to be useful for the purpose of the fields which may, in process of time, be reclaimed. But this will require to be done with great judgment, and only decided upon when a thorough inspection and investigation of the lands to be reclaimed show that they are of such a character as will ultimately repay the cost of reclamation. Other and general considerations connected with the laying out of farms will be found discussed in the next chapter. Circumstances, which will be taken into account by the proprietor and his professional advisers in the management of the estate, will, however, decide cases such as these; and that much and accurate judgment in the decision must be exercised is obvious, when it is remembered, what we have already stated, that in many instances so-called "waste lands," of whatever class, are not capable of being reclaimed in the practical sense of being made to pay for the outlay which the work involves; and so long as this is true, so long will it be the case that much of those waste lands must remain as they are, unless the "spirit of the age" find out some mode of utilising them, other than that of farming them under any of the methods at present in use. (See "Reclamation of Waste Lands," under its heading in Chapter V.)

CHAPTER IV.

MANAGEMENT OF THE PROPERTY—DIFFERENT PARTIES CONCERNED WITH IT, AND THEIR RELATION AND DUTIES TO ONE ANOTHER, AS PROPRIETOR OR LANDLORD, BAILIFF, MANAGER, OR CHAMBERLAIN—TENANTS AND LABOURERS—THE ERECTION OF BUILDINGS, LAYING OUT OF ROADS, AND GENERAL WORK OF THE ESTATE.

HAVING in the preceding chapters taken into consideration various points connected with the local, general, and special characteristics of the property, and discussed as fully as space would admit of the laying out and distribution of its special parts, the remarks being mainly confined to leading principles, we have now to take up the practice, and consider the management and its details by which that practice is carried out.

The Landlord: his Duties and Relationship to the various Parties on the Estate.

The first point which engages our attention will be the various parties concerned with, and interested in, the successful working of the estate, those being the landlord or proprietor, as the chief, and under and connected with him by the ties of a business relationship, as the agent, chamberlain, general manager or overseer, the under or farm bailiffs, and the tenant and his labourers. At first sight it would appear that the work which each of those classes would have devolved upon it being different, the relationship and duties of the individuals composing them to each other would be reduced to a matter of extreme simplicity. The bargains or special agreements being made between them and the head or proprietor of the estate, nothing more would seem necessary to be done than seeing that the details of those were fully and fairly carried out. While this is true in a general sense, still, in a special one, it is also and markedly true that much of the success as to the ultimate results of such bargains or agreements will depend not only upon the ability with which, in the first instance, they are carried *out*, so as to meet the whole requirements of both or of all the parties, but in the second, and perhaps more practically important instance, on the way in which the work is carried *on*. The relationship of the various parties to one another is characterised by many considerations, some of which are at times very conflicting; and difficult, without tact and management, to be dealt with satisfactorily; they are so thrown frequently into close contact with each other, and so many points come necessarily up for consideration in connection with what may be called the daily work or routine of the property, that no less tact than judgment is demanded by them. It is obvious, therefore, that a vast deal of the harmony with which this work is carried on—and with this its practical success and the consequent prosperity of the estate—will depend upon the character, the peculiarities, and the business habits of those concerned in its management, influencing and being influenced by each other, as they must be, in a way more or less direct and observable. Space does not permit of the various points to be taken up and dealt with in that fulness which would be desirable in a larger work, but from their importance it will be well to glance briefly at some of the leading ones.

Obviously at the head of what may be called the "working confederation" of the property stands its owner or proprietor, generally known as "the landlord." Although in one sense it may be said that his relationship to the other parties which make up this body is simple and easily defined, he giving so much to them, and in turn receiving so much from them, leaving details to be decided upon, and work done by those to whom is entrusted the management of the property; still this is taking the narrowest possible view of the position of the proprietor acting as a landlord, nor would many feel themselves complimented if it was so put to them as conveying all that was expected of them. While there are some landed proprietors who are distinguished—if the term can in such a case be applicable to them—by taking no interest whatever of a close and personal kind in their property, save that of drawing the rents, "receiving as much and doing as little in the way of giving as possible," as some one has put it, is but too true; it is nevertheless a matter of truly national gratification that the general body of the landed proprietors of this country do not belong to this class, which, however large at one period of its history, is small now, and is daily diminishing. Many facts could be cited to prove this, we but allude to one—the records of the doings of our leading agricultural shows and societies. That a landlord will find it his interest to be interested in his property, to know something, at least, of the general details of its management, is but the statement of a truism. But more than this general *kind of interest* is required of him, and in a large *number of instances* this higher interest is displayed in a variety of ways gratifying and satisfactory. That a knowledge of the arts and sciences bearing upon agriculture, of the special characteristics of land, and of the still more special details of practical farming, cannot fail to be of high value, and abiding intellectual pleasure as well, is obvious enough; and not a few of the landlords of the kingdom—some of them of high rank and position in the nobility and gentry—do possess this knowledge, and apply it with rare skill and tact to the improvement of their properties. Nor will the landlord lose but gain in dignity, as lose he certainly will not in pocket, if he cultivates and practises a real hearty interest in the well-doing and well-being of all in his employment, and acting towards him either in the relationship of managers or agents or tenants. The landlord's power for good in this way is great, nor will it be ineffectual even although it be at times practised in a quiet way. Tenants soon find out, without much personal intercourse—or personal fussiness, which is what they do *not* like—whether or not their landlord has or has not their interest at heart; and if he has, his interests will be all the better cared for, for one naturally takes a pleasure in trying to please those who are trying to please him. Men are not nearly so bad as some cynics say they are —very much better indeed.

Of the Chamberlain, Factor, Agent, Bailiff, or Overseer.

When the estates are "vast and ducal," spread over different counties, and often in more than one of the three kingdoms, their general management becomes a *matter of immense importance*, and is usually entrusted to gentlemen of the highest position in educational and scientific attainments, under various titles, some with the higher or more imposing dignity of "chamberlain," others with those of a less imposing kind, as factor—a capital name, involving, as it does, the "doing" of something, or being somewhat of necessary or essential value. Under him come the agents or managers of the estates in the different districts, and under those the tenantry, &c. For the purpose of our work it will be better to suppose the case of a single estate, but that so extensive as to embrace within its boundaries every variety of land, so that we shall thus be enabled to refer to them all, and to note the leading characteristics of the methods by which the maximum of produce and consequent rental can be obtained from them.

Such an estate is generally managed, as a whole, by a gentleman called an "agent," who is generally, at least very frequently, connected with the legal profession. While a great deal could be and has been said on the subject of the qualifications of agents, we shall not advert to what he ought not, but simply as to what he ought to be, in those respects, and this may be said in a sentence or two. As a business man he ought to have an intimate knowledge of accounts, of business forms, agreements, leases—in short, of all the varied and ever-varying matters which are coming daily up for consideration on a large estate in which there is large "expenditure" and "income." To these general business qualifications he ought to have special ones, such as a knowledge of land in all its details, and of agriculture, whether considered as a science, with its theories, investigations, and deductions, or as an art, with its practical details as applied to farming. To these professional qualifications he should add moral and intellectual gifts; be of a kind, conciliating disposition, yet prompt, energetic, and decisive withal. It need scarcely be said that such an agent will not manage the estate as some agents are said to do—from his office alone, seated with his papers and accounts, &c. However well those be carried out and attended to, personal attention, of a close and searching character, he will be sure to give. Fortunate the landlord who finds such a one—the "right man in the right place." That he will exercise the necessary degree of care in the choice of his agent, is, of course, here understood; but that choice being once made, the agent should not be hampered and bothered with perpetual interferences, but, where changes are deemed desirable by the landlord, they should be presented to the notice of the agent with tact and courtesy—which they will be sure to be, the proprietor being—as we are pleased to assume he will generally be—a gentleman in feeling as well as position. (See remarks at the commencement of this chapter.)

On being appointed, one of the first duties of the agent is the selection of the bailiff and the tenants. Taking the *bailiff* or *overseer* first, the varied nature of his duties may be gathered from the fact that with him rests not only the practical working and management of the "home farm," but the planning, superintending, and carrying out of the general work of the estate as placed before him by the agent, the selection and superintendence of the workmen, and the making out of the accounts of the whole work entrusted to him. He must therefore have a thoroughly practical knowledge on all points connected with the land and its management, as also of practical farming; and coming much *in contact with* the tenantry, he must be a man of education and intelligence, possessed of good manners, of a kind, conciliatory, yet firm disposition. Endowed thus, he will so please his employers, that before long he will rise to a higher position and greater influence.

On the Qualifications and Choice of Tenants for the Farms of the Property.

It is impossible to over-estimate the importance of this department of the management of the property, inasmuch as it is the end or ultimate point to the attainment of which the labours of all the others contribute, and for which they are indeed carried out; so that it may be said to be the realisation of their work, as securing the success of the estate as a paying property. With the tenants rests this success, for if through incompetence, or through any other cause, they are not what is suggestively and generally known as "good tenants," and fail therefore to pay their rents fully and with punctuality, whoever gains, the landlord cannot possibly do so. Their interests are therefore bound up together in the closest of ties, and what acts prejudicially in the case of the one reacts in the case of the other.

And even in view of that vexed question of agriculture, a *bête noire* of so many of our politicians and proprietors—the "tenant-right question"—although it may be granted that the greatest preponderance of legal rights is in favour of the landlord, and although the tenant may thus be apparently bound down by the force of enactments and the stringency of agreements, *it is obvious that* no amount of these can provide against *the contingencies,* or make good the losses arising there-from, of incompetence in practical knowledge, want of prudent business habits, or the lack of capital, and the commercial skill to deal best with it on the part of the tenant. Those are attributes which cannot be bought, cannot be secured by any law however strong, by any agreement however stringent and binding in its clauses. If secured at all, they can only be so by the exercise of care, discrimination, and sound judgment on the part of the agent of the estate.

And difficult as are the duties which an agent has to perform, and disagreeable at times as is the work he has to do, we doubt if there be any duty or any work which will test his abilities and prove his capacity to occupy the post he holds to a greater extent than that of the choice of the tenants of the farm. In one sense his duties in this department may be said to be much lighter and easier now than they were, not so many years ago. Then farming by no means occupied the same position, and was in no sense the popular business it is now. Farms, therefore, were easy, or at all events not difficult, to be had; and when to be let, farmers desirous to take them, if they met with competition, it was the competition of brother farmers. But by a combination of circumstances, the details of which it is unnecessary to go into here, matters have changed very much of late years. Trade, commerce, and manufactures have pushed forward their outworks, so to say, that the wealth of those engaged in them has increased in the aggregate enormously; and as it seems to be part of the character of our countrymen to be looking forward in their earlier days to the time when they will be able to retire and to live upon and farm some land, a race or *class* of competitors for farms has *sprung up which has* tended greatly to increase the demand for farms, as well as on the average to raise their letting value. Nor has the general prosperity been unshared by farmers brought regularly up to the business or profession, for the increased wealth of other classes has created a demand for farm produce, and prices of this, from one cause or another, have increased also; so that rich farmers are by no means the difficult men to be found they were years ago.

These causes, and others which we might name here, although less potent, still tending to increase the desire to have farms by a much wider and a more wealthy class of people than before, make apparently the task of finding good tenants on the part of the agent very much easier than it used to be. Tenants, in fact, force themselves, as it were, upon his notice, and almost clamorously compel him to accept them for his farm. But it is not all gold that glitters, and numerous as may be the claimants for the farms he may have to let, they are not free from the chances of loss or failure now, any more than in days of old. Farming well conducted pays, but only moderately at an average; but where ill conducted, it absorbs the capital and wastes the resources at an alarming rate. And it may be easily conceived, from what we have said, that amongst the men of the classes we have named, there must be many who are almost totally incompetent to conduct a farm properly. The qualifications of a farmer are therefore necessary to be known to an agent, and as these involve considerations of extreme importance to both him and to his tenants, as well as to those who may be designing to be agents, and who are therefore studying for the same, it will be necessary *here briefly to* point out what those qualifications are *which contribute* to the success of farming.

And here at the outset we must notice a very singular circumstance connected with farming. Other businesses demand a careful training—years of primary apprenticeship, and afterwards of what may be called a secondary one, in which further and a higher and wider range of experience is obtained; and all this before the young man is supposed to or considers himself fitted to be a master, with all its cares, responsibilities, and demands upon the higher qualities of his character. But in farming all is different. So far does the popular opinion of it run, that it is supposed to be the simplest and easiest of occupations to follow out—so easy that any one, no matter what has been the previous nature of his calling, and what the bent of his inclinations, can at once take it up and practise it with success. It is needless to inquire as to how all this erroneous estimate of farming has arisen. The popular literature has had much to do with it; probably the love of the country and its pursuits, which seems to be a part of the British character, has had more. In a large number of instances there are those who, having retired from other callings, have taken to farming, the wish has been father to the thought that all about it was pleasant and profitable—a state of dreamland out of which not a few have had a most unpleasant waking. They have rushed quickly into it, and have been, so to say, pushed as quickly out of it. Now, the truth is that farming, in place of being the easily carried on business it is popularly supposed to be, is one which, on the contrary, demands not merely a thorough knowledge of its practice in the field and fold, an acquaintance with much of the practical science of the day, but requires, on the part of its followers, the exercise of powers of observation, a ready-wittedness in taking advantage of favourable and in avoiding unfavourable circumstances of soil, climate, and locality as regards the crops, and the same as regards the habits, peculiarities, and characteristics of animals; which together exercise no small degree of pressure on the thinking faculties. But more than this, not merely is farming connected with production at once of inanimate and animate materials, but being of necessity concerned, and strongly so, with the realisation of these in the shape of money, the farmer is compelled to have nearly all the habits of other business men, and is called upon perpetually to exercise energy, business tact, far-seeing skill, and prudent management of resources.

Farming, then, being what it is, no one need be surprised to learn that even to those who have been well trained in the early part of their career in its principles and practice, and who in business for themselves put these to use, and work hard—very hard withal, for days of toil and nights of anxious thought are the true farmer's lot—not always is success granted. There need, then, be no wonder that so many of the amateur class fail. The wonder is that any should succeed. But certainly some surprise may be allowed for what we have stated, that of those who have all the qualifications to insure success many do not nevertheless succeed. There must therefore be some grave reasons for this. These lie in the fact already hinted at, that farming, in place of being an easy happy-go-lucky calling, is one which demands so rare a combination of high qualities that it is not every man who possesses them, and even where possessed, the tact and skill to direct them aright is lacking.

It is indeed mainly for want of the right management *of the various* resources he has at his command, internal to and external of himself, that the farmer fails to find profit in his labour. There is such a fine adjustment of the various details of farming to one another, and such an intimate connection of one branch with the other, that unless worked out in practice as one harmonious whole which it thus is, failure is sure to be the result. Farming, to use a familiar simile, is like one taking up the long length of a chain, who has not only to number its links, but to estimate the strength of each to resist a given strain; and who, if he fail in connection with but one link, the work is failure throughout. Another way of expressing the well-known saying, the strength of a chain is in its *weakest* part. To succeed in farming, then, to the qualifications specially connected with its principles and practice, such as knowledge of soils, manures, crops, and the best methods of working and using them—of the live stock or the animals of the farm, their selection to suit its circumstances, their breeding, feeding, and general management, in all of which there are a vast number of details to be attended to—the farmer must add a capability of so balancing or adjusting the whole work that all will work smoothly, and no time be lost in returning, so to say, one work upon another. But while attention must thus be paid to what may be called little things, the non-attention to which results in a loss so heavy that but a small percentage know or think of it, and far less are able to estimate it, there must be also the adjustment of different departments to one another, and the close attention to the more important ones of the farm. Much more could be said on this important part of our subject, but space prevents us from doing this. Enough, however, has been said to show the importance of the duties of the tenant. Putting aside all considerations whatsoever, whether of a personal, political, or local kind, the selection of the tenantry should, it appears to us, be done purely upon business principles. These alone will secure the class of farmers who, to abundance of capital to do justice to the land, add a thorough knowledge of the kind of farming which they propose to undertake; to which, it is scarcely necessary to say, should be added the higher qualifications of being men of the highest moral and business or commercial standing. Connected with the selection of the tenantry comes up the question of the terms upon which the farms are let, whether on yearly tenancy or that of

Farm Leases.

A very important part of the relationship which exists or may exist—for in many instances the matter has no existence—between proprietor and tenant, is the "farm lease." The subject has been discussed with so many *pros* and *cons*, and so much animus has been introduced into the discussion, that it is exceedingly difficult to continue it with anything like the calmness which ought to be connected with all points concerning a scientific question like that of the progress of agriculture. But then the one side—the tenants—maintain that it is not at all a scientific question, and this too with much show of reason; that, on the contrary, it is one connected, and that only, with their position as "working men" concerned in getting a living; that this living cannot be properly made sure to them without the necessity of a lease. Of course all do not hold strictly to this view, for they go further, and say that the question of farm leases is a scientific one, inasmuch as without them farming can never be carried on scientifically; and for this simple reason, that the farmers, not being secure in the possession of their farms, cannot and will not lay out in the improvement of their farms those sums which alone could make certain the fact that those improvements would be worth anything. In brief, they maintain that unless the tenant be made sure that he will be repaid the sums he lays out in improvements, he has no inducements to lay them out at all.

It is, it must be confessed, very difficult to controvert those statements, which are, to say the least, founded upon common sense; nor is it easy to see how they can be objected to by landlords, inasmuch as what goes to improve the land as done by tenants must be beneficial to the property of the estate. A farmer is not likely to do anything for his farm calculated to increase its produce if, before he can realise the benefit of the outlay incurred by it, he is apt to be turned out at the end of the year. Neither proprietors nor their agents can possibly know what is wanted in order to improve it as tenants who work it and live by it. And when we find a large majority of farmers in favour of leases, at least of nineteen years' duration, it is a strong argument in favour of their adoption. Yet, as if to show how two-sided a thing is farming opinion, not a few very practical men have been heard to declare, that if they had the option between taking a nineteen years' lease and keeping to the yearly tenancy to which they had been accustomed, they would prefer the latte—ran instance we fear of the force of custom, inasmuch as it is difficult to see how the principles to which we have above alluded as forming one of the strongest arguments brought forward by other practical men, in far greater numbers, *do not apply* to them. Of course the other side have their view of the matter, and those who oppose the principles of leases—chiefly, as may be conjectured, those connected with land—hold views precisely the opposite of those we have shown to be held by intelligent farmers, and maintain that, so far from being likely to promote the progress of agriculture, they are almost certain to have the opposite tendency, and that they are moreover calculated to keep down the status of the farmers themselves, and prevent them from rising in the world. It is somewhat difficult to conceive how the latter argument can be correct, although it is of course possible that one may conscientiously believe that the first is correct.

A lease has been defined by a writer on the subject, who takes a fair view of both sides of the question, as an agreement or "contract for the possession and profit of lands and tenements on the one side, and for a recompense in the shape of rent or other income on the other." And as regards the length to which leases should extend, the period of nineteen years, so often quoted as the best, seems to have arisen from the experience of certain districts which have become celebrated for the efficiency of their farming, and which has doubtless been attributed largely to this, although other causes have also unmistakably contributed to it. It is difficult to conceive why there should be anything so specially valuable in an arbitrary arrangement like this, one in which apparently no principle is involved. The proposal made by the writer just quoted from does involve a principle easily applicable to all cases, and one which appears sound and reasonable. It is that the length of the lease be proportioned to the rotation which *best* suits the soil of the farm taken as a whole; in other *words, that* the lease should be a multiple of the years of the rotation—a four course (or four years' rotation) being a twelve years' lease, a five years' rotation being fifteen, the six course eighteen, and so on. Many advantages would accrue from this arrangement, not the least being this obvious one, that at the expiration of the lease the same fields would be under the same crop as they were at the beginning of it, so that a fair means would be afforded of judging of the fact as to whether the style of farming adopted during the lease had or had not improved the land. One advantage of the lease system should never be lost sight of, and it is not easy to bring any argument against it; and it is this, that a lease extending over a number of years tends to equalise the seasons, giving the farmer the advantage of possessing the good years to make up for the losses of the bad ones. Upon the whole—for the subject is such a lengthened one upon which page after page might be, as they have been, written again and again—why should the matter not be left to the tenant, to give him his choice as to whether he would prefer a lease or not? The proprietor has always his remedy in the terms upon which the lease is to be drawn up.

But upon this point of terms no end of writing and speaking has been exhausted, and with apparently very little result. But it certainly does appear a very common-sense principle upon which to proceed, and which is well worthy of the attention of the young proprietor—who may be presumed to be less influenced by the preconceived notion of years of practice of older proprietors—namely, that the terms of the lease shall not run counter to the established principles of agriculture, so as to prevent its best practice being carried out. Space does not permit us here to give examples of some of the clauses which *are often inserted* into leases; but suffice it to say, that they are utterly prohibitive of the proper course being taken which an intelligent farmer would take, and which the principles and practice of modern agriculture alike show should be taken. Such clauses are but the relics of a time when farming was in its rudest and earliest stages of progress, and are quite beneath the times such as the present. It may be asked, why do farmers take farms bound down by such antiquated and absurd regulations? To which we can only reply, it is difficult, as it is unsafe and uncharitable, to judge of a man's reasons and motives. These he knows better than any one else, although it is an old adage, which may be added to those we have already given, that the "world knows a man's business better than he knows it himself." As a natural result of the connection of a farmer with the land of which he has had possession for some time, came up the question of such improvements as he had made in it during the term of his occupancy, however long or short that may have been. These might have been of such a character that he gained the full advantage of them during that occupancy, so that in no sense could he be said to have been a loser by the transaction when he was called upon to leave the farm, either upon the expiry of his lease if he had one, or at the shortest notice if he were a tenant-at-will. But it will be obvious even to the tyro in agricultural practice that the general character of its details is such that the great majority, at least a large number, of them must be of that nature, that a large proportion of the "money sunk" in making such improvements would remain on the farm, and would go to the benefit of the next or incoming tenant. Then came up as a natural result of *all this* the "Tenants' Right" question, by which was *meant the right* of the tenant to be compensated for such money as he had, so to say, invested in the improvements he had made during his tenancy. Long and fierce were the discussions which the question gave rise to, and on both sides they were carried on not always with the amenities which one naturally expects from men occupying the relative positions of landlord and tenant; but when money questions—and those involving often large amounts—are brought to the front, it is difficult to maintain the courtesies which under other circumstances are expected. There can be little doubt, after all is said, that it is a point very difficult to be controverted, that if a farmer has put into his farm certain amounts, say, of manure, or erects some structures, both of which tend greatly to improve the property, that if these are not exhausted, or, in other words, if he has not got the full advantage of those improvements before he leaves, some one is the better for them—either the landlord who owns the estate, or the tenant who may have to succeed him. This principle holds good in other business transactions, and it is difficult to see why it should not do so in agricultural ones.

The points were at all events so obviously common sense, and they took such a hold of the public mind, that it came up repeatedly before the Legislature, and at last the discussion took form and shape in what is called "The Agricultural Holdings Act (England)," passed in 1875. In some districts, previous to the passing of the Act, and in some instances where special agreements were made, "compensation" for unexhausted improvements were allowed for, but only under such circumstances; and, as already stated, unless under such, a tenant on leaving his farm found that his improvements, however costly, "became the property of his successor;" but under this new Act he has now a legal claim to compensation for them, and such compensation will become universal.

Where compensation is already—that is was, previous to the passing of the Act—secured by custom or agreement, the Act will make no change; but where farms have been held "at will," as the practice is called, or under agreements which do not provide such compensation, either the Act will apply, or agreements framed in the spirit of the Act will apply." Such are the words of a brief but suggestive commentary upon the Act by Mr. C. Randell, of Chedbury, Evesham, who in the number of the *Journal of the Royal Agricultural Society of England* (Second Series, vol. xii. part i., No. 23) draws attention to a form of agreement adopted upon the estate of the late Mr. Holland, M.P., to whom agriculture in many of its aspects was greatly indebted. Mr. Randell believes that it would be useful for those who contemplate the drawing up of agreements under the Act of 1875, such as we have already alluded to, to consider these agreements of Mr. Holland. They are far too long to be given here, so that we can only refer the reader to the number of the journal we have named, in which they are given. But we may note here that, as they contain provisions which could not have been embodied in the Act of Parliament (1875), it seems desirable that, while fully recognising the intentions of this Act, there should be agreements of tenancy defining how the tenant is to be paid for the unexhausted value of his purchased manure and food; and further—which is very important, and for which the Act apparently does not provide—how he is to *return to* the land during his tenancy an equivalent for *the produce sold off* of it, and in what state he should give up the farm when that expires. Further, those agreements give—what Mr. Randell states the Act could not attempt to give—freedom as to cropping and disposal of produce (see a preceding paragraph on those two important points under head of Leases); that they give a larger amount of compensation for unexhausted manure and food than the Act gives—under which a tenant has no claim after taking a crop of corn—the agreements recognising the undoubted fact that when such manures have been applied to the growth of turnips eaten off the land by sheep, which are at the same time fed with oil-cake in addition, the benefit to the land is not exhausted by one crop of corn, but extends to the following or succeeding crops of clover and wheat.

The necessity, however, of extreme carefulness in incorporating agreements, however valuable these may be supposed to be in themselves, with the Act as now passed, and however closely these may run or be supposed to run in agreement with the spirit of it, is very evident. And its importance is somewhat curiously illustrated by the concluding words of a very brief but suggestive paper by Sir T. Dyke Acland, Bart., M.P., in the very same number in which Mr. Randell's paper appears, drawing attention to a clause in the Act. Sir T. D. Acland's words of warning are these: "The whole question of incorporating existing agreements with the Act is one which requires careful consideration. The same may be said of framing new agreements in accordance with the Act, defining what is vague, and adapting the Act to the circumstances of different districts." In concluding our remarks upon this department of our work, we deem it right to point to the fact that to those who wish to gain a clear view of the provisions of the Act (1875) we would recommend a perusal of an admirably drawn-up paper on the subject from the pen of Mr. Frederick Clifford, of the Middle Temple, Barrister-at-Law, which appears in the same number of the Royal Society's Journal in which Mr. Randell's paper is given.

The Labourer.

The relation which the tenant bears to the agent and his landlord is much the same in kind, although different in degree, as that which the labourer bears to his employer, the tenant. There has been no class of men connected with the labour of the kingdom about which so much has been written and said as the agricultural labourer. He has been the theme of innumerable platform speeches and press utterances, many of both of which have been characterised neither by correct judgment of the case as it stands nor by the accuracy of their facts, or rather so-called facts. For long the subject was discussed—as indeed it was only necessary at that early period to be discussed—apparently from the purely philanthropic view; but of late years it has entered other phases, partly political, but chiefly connected with the rise of wages, with which have been associated the movements of strikes and lock-outs, both of which are equally to be deplored as in the end advancing the true interests of neither the farmers as the employer nor the labourer as the worker, nor for the interest of agriculture as a calling, in which both alike are equally and closely interested. The best result can and will only be obtained, and the true relationship *between both* employers and labourers maintained, by *the exercise of a* just and accurate view of the respective duties towards each other, in which the farmer will be not only liberal in his pecuniary dealings, but careful of their best interests social and moral, and we also venture to add, religious; while the labourer on his part will not conceive that all he has to do is to get the highest possible price for his work, regardless of the interests of his employer, and thinking only that his relationship with him is all one-sided, in which he has to get all done for him but has to do nothing for himself. A mutual sympathy as to feeling and position must be maintained on both sides—a position which is by no means one-sided, as of the two the labourer is, perhaps, the one most apt to conceive. These remarks, with which we close this department of the subject, have indeed a wider application than to the case of the labourer only; for they convey the principles of the true relationship which should exist between all parties connected with the property, thus embracing the highest as well as the lowest in position.

The General Work of the Estate.

Having discussed what may be called the administration of the estate, as that which decides upon and regulates the conduct of the work to be done upon it, we are now prepared to glance briefly at what that work is. In this section we shall, for the convenience of arrangement, and as facilitating the discussion of the various departments, concern ourselves only with what may be called the general work, leaving for another chapter the consideration of the cultivating management of the estate. The first part of this work is that connected with the laying out and general distribution of the various localities and farms, upon the principles as expounded in Chapters II. and III. Of these, the first we shall take up is that which is generally the first work done, namely,—

The Laying Out and the Construction of Roads.

Work of this class is very apt to be, and indeed too often is, neglected, and this arises from a mistaken view of its importance, or rather the want of it, as if roads could be neglected without in some material measure affecting the economical working of the farm. This remark applies with no less force to all the outlying work of the farm, as fences, gates, ditches, &c. But a very brief consideration of the relationship which exists between all the departments of the farm, and to which we have elsewhere in this volume drawn pointed attention, as conveying much that is of great practical value, will show that one department cannot be neglected without seriously affecting some of the others, if not all of them. We have heard the woefully neglected condition of some farm roads defended on the ground, that being so seldom used, it did not pay to make good ones. It is only for a reason like this that we can account for the fact that, as a rule, on many estates the roads are disgracefully bad. But if the traffic be not great on farm roads, it should be remembered that it is often heavy, and requires, moreover, to be done at times so promptly that the chances afforded by certain conditions of the weather—as, for example, in the carting of manure to the fields—should not be thrown away. But not only do bad roads incur a great loss of time, *but it* should also be remembered that the animals *which work upon* them are very valuable, and are peculiarly liable to be hurt by excessive strains upon their systems. A bad road may thus cause a loss which would have more than sufficed to have made it a good one.

The same reasoning will apply to all the other outlying works of the farms, to which may be added this: that the time lost arising from defective work—as, for example, badly hung gates, or gates not hung at all—comes to be a very important item in the expenditure of time and labour of the farm in the course of a year, or of a lease.

As regards the outlying work of the farm and the appliances of the fields, as roads, fences, gates, &c., it is obvious that so much of a practical character might be given, that space infinitely greater than we can possibly here have at command could be filled up with it. We can, therefore, but glance at a few only of the leading points, and this in very brief fashion.

Nor does the exhaustive treatment of the subject come within the scope or scheme of our work, these embracing, as its title indicates, "outlines" only of the various departments. Moreover, the reader desirous to supplement what we have given in this brief form by matter more full and precise, will find what he requires in one or other of the many practical volumes which go to make up the series known as the "Rudimentary," and which is issued under the care of the same firm which publishes the present volume. Practically connected with the contents of these works, the writer of the present one can state with confidence that they will be found to comprise all, or nearly all, the points which require to be considered in connection with the various subjects.

Taking the *roads* lying round the steading and those traversing *the farm, it* may be said that, so far as the *majority of instances* are concerned, these are not wha they should be. To say nothing of the careless way in which they have been laid out or "surveyed," by which considerable time is lost in the aggregate work of the year in going over unnecessary ground, or of the badly designed curves and junctions, such is the state in which a large proportion of the surface is allowed to remain, that no small extra work in horse labour is caused. And it is not merely from the fact that this labour is lost, but it should be remembered—what has been already alluded to—that from the extra strain thrown upon a horse by a very bad bit of road, a fine and valuable animal may be injured perhaps hopelessly. The legitimate work of the farm in ploughing, &c., is quite heavy enough, without adding to the work of the horses by having roads in "shocking bad repair," if the phrase be not absurd where no repair is ever attempted. The mere filling up of holes or ruts by throwing down a cartload of stones here and there, or spreading a barrowful on parts out of the level, is not putting roads in good order. The work must be thoroughly done, for if not matters simply get worse. In nine cases out of ten the easiest and cheapest way is the most difficult to do, and the dearest in the long run. Where roads have got into bad condition, it will be the cheapest, as it certainly will be the most satisfactory, way to relay them. This need not be done over a great length, but sections may be taken in turn till the whole are in good order.

In the formation of roads, the great mistake made in too many cases is, supposing that all that is necessary to be done is the marking out of the line, partly excavating the surfaces and levelling them, and then throwing *down loads of* stones of all dimensions, and of all kinds *and qualities*, and levelling them "after a fashion."

This is not road-making. We shall endeavour in a few sentences to show what it is, not necessarily going into such minute details as would be essential in considering the art as applicable in important country roads, but viewing the subject simply as connected with the ordinary roads of the farm.

There are three points in the construction of roads which are essential to be attended to—first, the "base, or bottoming;" second, the "upper" or "carriage surface;" and third, the "drainage," which includes the finishing of the side parts of the road. As in all work the character of the foundations determines largely that of the superincumbent work and its lasting nature, or otherwise, that of a road must be closely looked to. Much will depend upon the nature of the soil, or rather subsoil, upon which the road rests; and in some cases this is of such a treacherous nature, arising from the presence of quicksands, bog or peat holes, &c., that the expense of removing such obstacles is often much greater than that involved in the diversion of the road, and adding even considerably to its length. And which of the two in such case ought to be chosen admits but of little or no doubt. In some soils indeed it is almost impossible to lay down a road unless at an expenditure of time and money far beyond the requirements of the farm. We have put "drainage" as the third requisite in a good road, but in truth it is essential, or rather we should say the essential necessary to be attended to and secured, before a good foundation can be made. Even very bad soils, and we might say the worst, can be put into that condition by careful men and deep drainage, that a foundation may be depended upon both as regards its soundness and firmness and its lasting character. The drains should be laid at a depth of not less than four feet, but four feet six inches will be better, and formed of the usual field drain; internal diameter not less than one inch and a half, but better of two inches. The reader must understand that these drains—as indeed what we have said of them must at once have indicated—are quite distinct from the side drains or ditches which bound the road right and left, and about which we shall have somewhat to say presently. The small field drains above referred to are for the purpose of thoroughly carrying off the water from and securing a dry foundation. The depth we have already named at which these should be placed; the lateral distance or breadth between them should be eight or nine feet. In heavy soils there will be no difficulty in digging the trenches for these drains, but in loose, sandy, or boggy soils a good deal of trouble may be given, and all the "nous" of the farmer exercised in order to overcome the difficulty. We presume the soil to be of such a consistency as to make the digging of the trenches for the drains—which we shall designate the "central" drains of the road—a comparatively easy task. The drain tubes must be laid with as great a fall as possible towards the cross drains, which will require to run transversely to the line of road at every point where an accommodation or field road crosses the line of main road. These cross drains will also be required at points in the line of main road where this dips very much, thus changing its general level. The junction of the central drains with the cross drains should be made as near the crown of the cross drains as possible. These cross drains deliver their water in the side drains or open ditches *which bound the* road right and left.

The soil between the central drain, that is, the soil of the centre part of the road, should not be disturbed or broken into any more than can be avoided in digging the trenches for the central drains; and should the soil appear to be loose and to have faults or cracks in it, it will be as well to hard ram it so as to consolidate it. We have said that the distance between the central drains may be eight or nine feet, this forming the centre or crown of the road. The distance between the centre line of drains on each side and the inside line of side drains or open ditches may vary from four feet six inches to five feet; if the latter, and the central drains be separated nine feet, the whole width of road from inside line to inside line of side drains will be nineteen feet. The depth of the side drains, or open ditches, should not be less than eighteen inches, and the width at top two feet six inches, and at bottom two feet. These side drains must have their fall as great as possible to prevent the stagnation of the water, and should lead to the nearest open outfall or watercourse, as a rivulet, &c. Wherever a cross road is met with, the ditch must be replaced by a pipe culvert, or if continued be crossed by strong planking to serve as a bridge. As open ditches or side drains are so apt in hot and dry weather to become mere receptacles at various points for stagnant water, especially where the level gets destroyed, it is a good plan to have a large tubular drain or sewage pipe running along the bottom, the crown within a few inches of the bottom of ditch. These tubes take up and convey the water to the outfall in such a way that no stagnant water remains in the ditches. It will be noticed that we have made no provision for side walks; but in the ordinary roads for internal communication between one part of the farm and another we do not conceive these to be requisite. *The crown* of the causeway may be used by the few foot passengers, or the side space betwee them and the open ditches. The road outside the ope ditches will best be finished off with wire fencing, separating it from the fields on either side.

We have hitherto treated the road as on a level wit the fields, or nearly so; but it may have to be carrie through them at a level either considerably higher o lower. If higher, and the road has to be upon a embankment, there may be engineering difficulties o such a nature as to necessitate the calling in of th aid of an experienced surveyor; roads on a lower level and necessitating cutting only, being as a rule mor easily formed. In many, perhaps in the majority, o both cases, the farmer may be able to meet all th requirements himself; this being likely to be the cas where the soil is of moderate and uniform consistenc In forming embankments, the slope or border at th sides should be as easy as possible, and each successiv layer should be carefully rammed down, and the leve that is in the sense of the length of the road, be teste from time to time, to ensure its accuracy. The grea point to be attended to in the formation of embankments is to have the layers as thin as possible; in nin cases out of ten failures arise from having them to thick, with the view of getting the work finishe quickly. The thinner the successive layers are, an the more uniform in quality the material and of ramming down, the better. The slope of the sides shoul always be less than that of the "natural angle of repose of the materials of which the embankment is forme the reader being of course aware that each material, heaped loosely up, sets itself at a slope or angle peculia to itself. The breadth of the embankment at top shoul *be such as to* admit of properly constructed open sid drains or ditches to carry off the surface water. Wire fences should be provided to the inner side of the ditches to prevent accidents. Some prefer to have the side ditches or open drains outside and at the foot of the embankment, thus saving the cost of those at the top; but the plan is by no means a good one, as it causes the surface water from the road to flow down the side slopes of the embankment, a fertile source of mischief to them. The slopes may be protected and covered with grass or a turf layer. In cutting roads the level of which is much below the surrounding fields right and left, the sides of the cutting will have their slope or angle dependent upon the character of the soil; a slope of two to one will be found generally useful. The surface of the cutting will be kept longer in good condition by having open surface drains running from top to bottom, at distances varying according to the soil, those drains delivering their water to the side drains or open ditches at each side of the road. The intervals between the open drains running from top to bottom of the cutting will be best if rounded off, or "hog-backed," which will deliver the water to them. This plan may be adopted indeed in the case of embankments, noticed above. As there will be great difficulty in many cases in getting the necessary fall for the under or central deep drain tubes, the drainage of roads in cuttings must, as a rule, be dependent upon the side ditches, the surface of the road being convex or hog-backed to enable the water to shed freely from right to left from the centre of the road. The surface metalling also in such cases will have to be deeper than in the case of level roads, and in some classes of very loose soil it may be advisable to rest it upon a bed of puddled clay.

We have now brought the consideration of the various points of road construction to that at which the form and mode of finishing of the upper surface must be taken into account. A great deal has been written on the best form to be given to the road surface, whether it should be flat across the line of its breadth, or convex, that is higher in the centre than at the sides. Much can be said on both sides. Where there is much traffic on the road, as only one cart or carriage can have the centre, which is the point each driver will aim at having, the other vehicles will naturally have to take the sides which are sloping. A flat-surfaced road will therefore be better under such circumstances, as no one vehicle will be better than its neighbour. But where the traffic is small, as in farm or accommodation roads, the convex form will be the best, as this enables the water to be shed freely off to right and to left to the open drains or ditches at the side; but the convexity in any case should not be great, and if the depth of the upper layer of metalling or broken stones—macadam fashion—be, say, four to five inches, this should be the height of the centre of road above the inner sides of the open ditches at the roadside. The curve or convexity of the road being thus decided on, the under layer of stones should be laid, the soil being previously well rammed down. The under layer of stones may be larger than the usual macadam stones, and the harder the better. The depth of layer may be from eight to nine inches, and the whole laid uniformly over the surface and well rammed down. The upper layer of all, being of the usual macadam stones, finishes the road. In metalling a road, as finishing the surface is technically called, just as in puddling or in forming an *embankment*, the shallower or thinner the layers put *on at once the* better. It may apparently save time to put down the whole thickness at once, but the unequal settlement which will afterwards follow will make it the slowest as well as the dearest method in the end. Where good and pretty uniformly large-sized gravel can be had, this will form an excellent top finishing for the road surface, care being taken to riddle or screen it well so as to free it from all earthy particles or soil. After the materials are all in, nothing will better tend to the long preservation of the road than a thorough consolidation. One of the greatest improvements in road-making in recent times has been the employment of the steam-roller; and if the landowner or farmer can get the loan of one from any near point and upon reasonable terms, its employment on the farm roads will be a cheap and a good investment. Failing this the ordinary roller may be used. Rolling requires to be done, however, with care, uniformity being the point aimed at, so that all parts of the surface shall be subjected to the same amount and degree of pressure as nearly as is possible. It is scarcely necessary to say that great caution is required in the use of very heavy rollers where the surface of the road is very convex or much rounded off, the tendency of the roller being obviously to crush down the curves of the road.

Fences and Gates.

Under the head of Plantations in this chapter will be found remarks on the subject of *Fences*, to which, therefore, we refer the reader.

Gates.

Whatever be the method adopted of fencing in fields, it is essential that the various points of entrance to them should be fitted up with gates of the neatest form, and fitted up with the most scrupulous attention to neatness, order, and security. That these are not the conditions observed in many parts of the country, let the wretched, rickety, tumble-down, and worn-out affairs, called by courtesy gates, testify. We should be very much inclined to make the condition in which the gates of a farm are a test of the way in which the farm itself is kept—"as the gates, so the farming of the fields they give entrance to." But putting what there may be of "joke" in this aside—although the point may be put for consideration in all sober seriousness—there is no doubt that by far too large a number of the gates of our farms are in a condition of which their owners should really be ashamed. In some instances, they are not, however, to be wholly blamed; for gates are supplied to them which, being constructed in defiance of all sound principles, cannot and do not remain long in good condition. But even in such cases the best is not always made of the bad circumstances, and broken parts remain unmended, and if they "fall from their fastenings," they are propped up in any fashion but the right one.

While capital gates are made of wood, which if looked after will remain for long time in good repair, the lightest, and at the same time the strongest and the most durable, are those made of wrought iron, the posts being of cast iron. The designs of the gates now offered to the farming public are, as a rule, varied enough in style, and range from the severely simple, adapted to a field, up to the highly ornate, calculated to adorn the entrance lodge of the avenue which leads to the mansion of the lord of the manor. But while all tastes and all purses are thus met, so far as design is concerned, it does not always follow that construction, and the mechanical design on which that construction is based, meet with the same degree of attention at the hands of the makers.

The best makers, no doubt, whose reputations depend upon the first-class character of the articles they send out, are fully alive to the importance of attending to the points last noted; but it is scarcely open to debate whether it be not the fact, that by far the largest number of gates in strictly rural districts are supplied by the small makers, the wheelwrights, and blacksmiths of the country villages or hamlets, so few, comparatively, of the "makes" of high-class firms being met with. Now, however much it be lamented, it is nevertheless the fact, that not many of the rural mechanics are acquainted with the first principles of "framing," upon which the good construction of a gate depends.

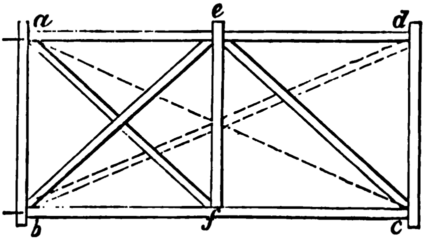


Fig. 10.

Nothing, indeed, can be more simple than the principle which dictates the form of the framing of a gate. It is simply dividing the rectangular frame, *a b c d*, Fig. 10, which is the main feature of all gates of whatever material formed, into two triangles. This is done by throwing across, from corner to corner, a diagonal bar or brace, *d b*, and, to preserve uniformity, two braces may be used, going from the other two corners. This division of the frame into triangles distributes the strain, and *throws them back, to* use a familiar expression, upon the parts which are the strongest, and lessening the strain upon the gate-post. But little observation is required to show that it is this which bears the whole weight of the gate-frame; that this frame acts as a long lever, the outer end of which is always tending to fall down, and to pull the gate-post forward and to bring it down. Whenever the end or vertical style, or outer end bar, *d c*, is found to be dragging along the ground and ploughing it up, as is too often seen, the fact is beyond a doubt that the strains upon the gate-framing are improperly distributed, and that they will continue to act till they loosen the gate-post. When ordering these gates from the makers who produce them on the great scale, or getting them made by the village carpenter or blacksmith, let the farm bailiff or estate agent see that the frame is provided with at least one diagonal bar or brace. The "up-filling" may be made in the most simple form by horizontal or vertical bars, or of a more ornate character with carved or diagonal bars, according to taste or fancy. And in the contract or bargain, provision should be made to uphold or maintain the gates for a certain period. Any one who can design a gate properly will do this without hesitation, as, if properly designed, it will keep for years in good repair.

The strain acting upon the "hanging style," or bar, *a b*, Fig. 10, produced by the whole weight of the gate-frame in front of it, is best met by the brace *d b* being of wood, as the strain on *a b* is that of compression, and wood is the material best adapted to resist this. The strain in the opposite direction, as *a c*, being that of tension, is best met by a light iron rod, which is well calculated to resist this strain. The form of gate very popular in a great majority of districts, represented by the frame *a b c d*, being divided by a vertical post, *e f*, and two struts or braces, *e b*, *e c*, is not, as supposed by some, a strong one; neither is that in which the brace is in the position *a f*. We again repeat, the only true principle of "trussing" a gate to get its strongest form is to divide the rectangular frame, as *a b c d*, Fig. 10, into two distinct triangles, by the use of a "brace," or "strut," from *d* to *b*, to resist compressile strain, and a "tie," from *a* to *c*, to resist tensile strain—the former being best of wood, the latter, the "tie," of wrought iron.

The gate-posts for farm fields are made generally either of wood or stone, it being only the gates manufactured by large makers in which iron is used. If the tails of wood posts be well charred, and this for some distance above the ground-level or damp point, or, better still, first painted with the tar preservative, and then set in a good deep bed of concrete, they will last a long time with a little attention. But where stone can be had this will of course be the most lasting material.

The Farm Buildings, Farmery, Home-stall, Homestead or Farm Steading.

We now come to the consideration of a most important department of estate work—the farm buildings. These go under different names in different parts of the country, the majority of which we have given above, the last being used almost wholly throughout Scotland, and some parts of the north of England, although, indeed, the term is fast becoming, so to say, naturalised south of the Tweed. A manufacturer about to rent a factory expects and will have it in first-rate *working order, so that* he can in it do full justice to his business, and as the landlord never dreams of protesting against such a reasonable and universally understood principle, so in like manner should the tenant of every farm which requires buildings have those in the best order and of the most complete character as regards arrangement. Yet although in the case above supposed the manufacturer would not take the factory if not fitted as promised to be fitted for his work, it certainly is a remarkable circumstance how many tenants are content to rent farms—to do justice to which good and ample building accommodation is required—in which the buildings are not only wretched in point of accommodation, but still more so in the condition or order in which they are. It would be matter of surprise to many if they could be made aware of the number of cases of this kind throughout the country. This ought not so to be; the landlord is bound to provide proper buildings to each farm; nor does his true interest even allow that a tenant should be permitted to take bad buildings however willing to do so, for the simple reason that without them he cannot make the most of his farm, and that, therefore, he, the landlord, must suffer in consequence accordingly. This common-sense mode of viewing the matter, if generally acted upon, would sweep away the wretched conglomerations of buildings even still more wretchedly kept up—if the term be allowable—which, as we have said, disgrace so many farms, and have them replaced by steadings or homesteads more in accordance with the real requirements of the land.

It is not enough, however, that old buildings should be replaced by new in farms already or long ago laid out, or be given as a matter of course to newly laid-out farms on estates newly acquired, or under process of improvement; it is requisite both for the sake of economising their cost, and of making them give for the minimum of cost the maximum of convenient accommodation, that certain principles of arrangement be duly considered and acted upon. The subject is therefore one which involves many points of importance, the due consideration of which obviously demands a mode of treatment, the briefest even of which that could be adopted being beyond the limits, if indeed it comes within the scope, of a work professing to give outlines only of a general subject involving as it does a vast number of details. What we can give, therefore, must be of the nature of a very meagre sketch, referring the reader to the work in this series on "Agricultural Building," by Mr. Andrews, in which will be found ample details on all the leading points.

In deciding upon the erection of entirely new farm buildings, the first point obviously to be considered is their site, or rather their situation. Correct theory would indicate the centre of the farm as the best for this, inasmuch as the carting of manure and other materials from the steading to the field, and of the produce of the fields to the steading, would thus be equalised. But in many instances this correct theory has to be modified in practice by surrounding circumstances. Thus, for example, a supply of water being of essential importance to the steading, this *must* be secured even if other advantages of situation be sacrificed; or the central position may be badly situated, as near a marshy plot or piece of land, or one otherwise unhealthy or unsuitable for building upon. One point should never be allowed to influence the choice of a site to the sacrifice even of a single advantage, this point being that there are *roads or there is a road* convenient; roads must always give place to situation, these being made to suit this, not the situation to suit the roads. The soil of the site exercises a decided influence upon the healthy condition of the stock; a gravelly soil is upon the whole the best, a heavy retentive clay the worst. The best aspect for the stock part of the farming is south-east. A level situation is best for economical working, taking the average of the work of the farm. Enough has been given to indicate generally that, while the central position is the best, there are circumstances which must be taken into account before deciding upon this.

The situation being fixed upon, the next point is the style and extent of accommodation, and the method in which this should be arranged for convenient working. On these most important points a treatise could be written, although many designers of farm buildings seem to think them of such little moment that they scarcely give them any consideration. It is right, however, to state that those are not men practically acquainted with farming, upon which of necessity the kind and extent of accommodation required in farmeries and their arrangement are based. Inasmuch as, as we have elsewhere in this work pointed out, there are different kinds of farming, there must obviously be a difference in the kind of accommodation required to meet the necessities of each particular kind; that for a dairy being clearly different from that needed for a mixed husbandry farm. Yet the class of designers above alluded to seem to think it essential to give to almost every farmery they design accommodation without any regard being paid to the fact whether it is required or not. The wants, therefore, of the farm should obviously decide the kind and *the extent of the* accommodation to be given. This *common-sense* principle is the one all practically conversant with farming act upon, and its mere mention is all that our space permits us to give, although much could be said about its various details. And in the manner in which they deal with the kind and extent of accommodation required, so do the class of designers we have alluded to deal too often with the way in which that is arranged, their principle, if this it can be called, being simply putting them in relation to one another "any way," as it has been graphically called. We can, as before, do no more than indicate in the briefest fashion what the true principle is—namely, that all the apartments of the farmery should be so placed, that the work done in any particular one or in any set of apartments should have a special and close relation to the work done to the requirements of that or those adjoining. This principle, also thoroughly common-sense in character, may be illustrated in the case of the cow-house or byre. This should not, as it often is, be placed at a distance from the straw-barn or the turnip-store, hay-house, or food-store, as time is lost in carrying the materials kept in them to the apartment in which they are to be consumed. So also with their relation to the manure or dung stance or pit, and the dairy apartments in which the milk is to be worked up into butter or cheese. The principle here named may also be stated in another way; the various apartments should be so placed in relation to one another that the work done shall go on in regular sequence, each step being in strict sequence to the one preceding it, so that no time shall be lost in going to and fro, and "returning upon one's self," as has been aptly said. We cannot profess to give in a work of so limited an extent as this is, and running over as it does so many and such important subjects, to do more than glance at the arrangements of farm buildings of various kinds adopted throughout the country. We can but give one or two outlined

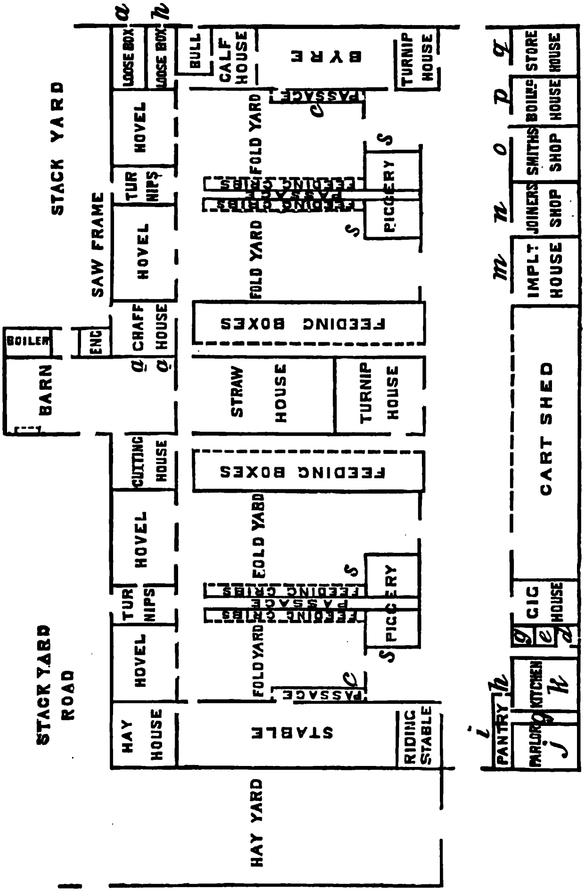


Fig. 11.

sketches, which, being the outcome of the practical experience *of* men engaged in the work of farming, may be ken, so far as they go, as representative plans. The

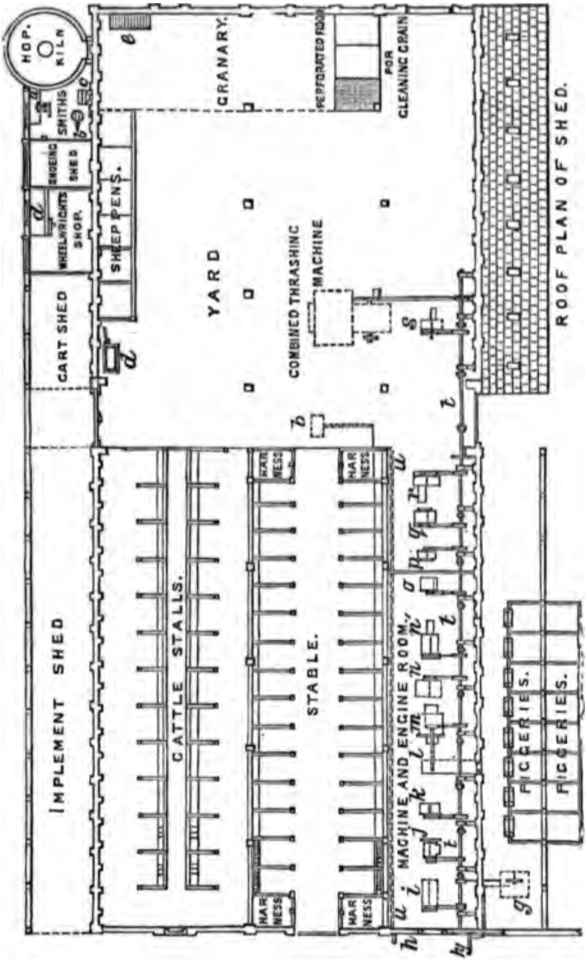


Fig. 12.

first, Fig. 11, is adapted and reduced from a drawing n the *Journal of the Royal Agricultural* Society. The second, Fig. 12, is the plan of a farmery adapted for a hop-growing district, in which mixed husbandry is carried on as well. This plan (Fig. 12) may also be taken as representative of a class of buildings much advocated by some, in which all the apartments are under one general roof—like that of a railway terminus. The plan also shows in a very complete way the adaptation of various labour-saving machines. The following is a brief description of the arrangement of this plan, which was erected in Kent by a then well-known firm. Near to the hop-kiln is placed the smith's shop, this being provided with a vice-bench, *a*, anvil, *b*, forge, *c*. Next to this is placed the shoeing-shed and wheelwright's shop, beyond being the implement and cart sheds. At *e* are placed the stairs leading to the granary above, while *f* is the root-slide for sheep. At *f* is placed a soft- or rain-water tank to supply the boiler, and to prevent encrustation in the same. At *g* is placed a force-pump, worked by the engine, drawing water from a well 200 feet deep, and filling a tank, *h h*, placed at such an elevation as to supply at considerable pressure all the troughs in the cattle and horse stalls. At *i* is placed the "root-washing machine," at *j* the root-pulping machine, at *k* the root-cutting machine, at *l* the boiler, at *m* the steam-engine, at *n* the meal-grinding mill, at *n′* the flour-mill, at *o′* an oil-cake breaker, at *p* the bean-mill, at *q* the oat-bruising machine, at *r* the straw-cutter, at *s* the litter-cutter. One marked constructive peculiarity in this farmery is the extensive use of corrugated zinc plates for the walls, or rather for enclosing the space occupied by the stock and machinery, and also the employment of wrought-iron roofs of large span so as to take in a very large space. We may also note here that zinc is pretty extensively employed in the neighbourhood in the construction of cottages. These are extremely neat in appearance, and we heard no complaints as to their being cold—damp they certainly could not be. Fig. 13 is the block plan of a design by Mr. Ewart, and is, says Mr. Andrews, in his "Rudimentary Treatise on Agricultural Engineering," "one of the best I have ever seen."

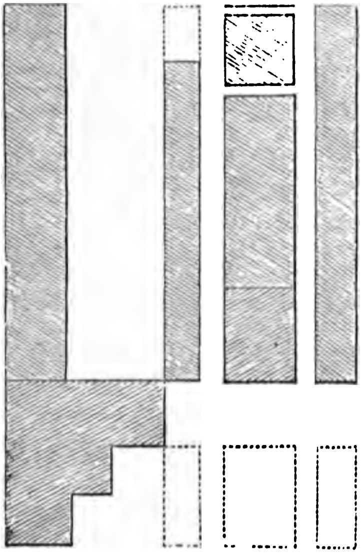


Fig. 13.

It consists of four parallel lines of cattle-boxes, an open yard thirty feet wide, and a line of stabling all parallel to each other, and running north and south.

The boiling-house is on the north end, and in the centre of the lines of cattle-sheds, and the threshing and straw barns on the north-west extremity of the whole. This plan is capable of very considerable extension, *without in any* degree impairing the usefulness of any of the original buildings for the purpose for which they were designed, which is a very important point to be attended to in designing the ground-plan of a new homestead. The accommodation consists of

Barn of two storeys.
Straw-barn or fodder-house, with granary above it on a second story.
Engine-room, and shed for engine-boiler.
Stabling for 8 horses.
Two loose-boxes for stallions, brood mares, or sick horses.
Receptacle for stable dung.
Shed for implements.
Turnip-house, fitted with steam apparatus.
Cattle-lairs in a double range for 12 fattening beasts.
Cow-house for 8 cows.
A single range of cattle-lairs for 12 beasts.
Ditto for 8 beasts.
Calf-house.
Liquid manure tank, to which the moisture of the stables, cow-house, and calf-house may be conducted by covered drains.
Open yard, 30 feet wide, and
A watering trough.

The estimated cost of this steading is £1,166 16s. 10d.

Farmhouse or Residence of the Farmer.

Next in importance of the buildings of the farm or the farm steading is the farmhouse or residence of the farmer. This, in size, amount, and kind of accommodation, and also in style, will depend upon the size of the farm. This rule, however, has its exception when a wealthy man, for example, is farming more for a hobby than anything else, and has only a farm of but limited extent, but who will naturally desire a large house. Such cases are, however, special, and must be met by special arrangements with the agent. But whatever the size of the farm, and of its accompanying farmhouse, the latter should have every convenience, and be well built. As in all other cases, there are certain points to be attended to—as the choice of situation, its relation to the farm buildings, roads, plantation, pieces of water, &c., the soil of the site, the supply of water, facilities of drainage, relation of the house to the kitchen garden, accommodation of the house, arrangement, style, and the building itself. All these, and others which will suggest themselves on consideration, require to be attended to, in order to ensure to the farmer what his position and comfort demand, and upon all of which much could here be given if space permitted. But as in the case of the farm buildings, so in this of the farmhouse, we have not this space, so we have to refer the reader to the work of Mr. Andrews already noticed as forming part of the series to which this work belongs, as we must also do in the case of the bailiff's or overseer's house, and the cottages of the labourers. As to the last of these, from what may be called its special position in agricultural economy, we deem it, however, necessary to give a few remarks on points not often alluded to in its discussion; and at the outset we remark that, if there has been for too long a period of years what has been called a "stern necessity" for cottages affording decent and healthy accommodation for farm labourers, that necessity is made, so to say, all the sterner, from the new and to many not altogether pleasing phases into which the agricultural labour question has within the last few years entered. The labourers are a "power" now, to use a modern term, and it remains tó be seen how this will further develop itself. Certainly it will be more requisite than ever to attend to their wants, seeing that they have now a greater "power" to enforce their claims to them. It is a new thing for farmers to find that "labour" is not as of old a "drug in the market," but that which is often difficult to be had, excepting on high terms, and *sometimes not* even on those.

This department of estate work naturally divides itself into three branches: first, that of repairs; second, that of alterations more or less comprehensive in the general arrangements of the cottages so as to make them more commodious and convenient, and in the consequent construction, so as to render them more healthy; and third, the building of new cottages on correct principles. On the subject of repairs but little requires to be said, save that it is somewhat difficult to understand how or why it is that landlords and owners of building property should have such a dislike to carry them out, seeing that nothing they can do is more economical. The proverb, "a stitch in time saves nine," carries with it a vast amount of practically valuable truth which somehow is strangely overlooked. A leak in the roof of a cottage, for example, which could be repaired for five shillings if done at once, if neglected to be done till a considerable period elapses, will cost as many pounds before the damage done is repaired. We are convinced, from what we have had to do and seen in connection with property, that it would pay, on large estates, to have a competent workman employed whose duty would be to be going continually about inspecting the buildings, to find out parts needing repair, or likely to be soon requiring it, and forthwith to have them attended to.

In connection with the renovation of old cottages—the second branch of our subject—we would, in the first place, advert to a very erroneous notion widely prevalent, this is, that there is little to be gained by the renovation of old cottages, simply because they are *old*, that it will be cheaper to pull them down and *build new ones*. Now it is just because they are old *that there lies* the almost certainty that it will pay to renovate them; if they are new, or comparatively new, we should say it would be better to pull them down. This may appear very strange to many, but it arises from not having had their attention drawn to the subject. In times gone by the work done in the way of building was right good honest work. Done in every sense of the term was it. The masters of those, in this respect at least, truly good old times, would have been as ashamed to have used bad materials, as their workmen would have been ashamed to have put them together in an unworkmanlike and dishonest, slovenly manner. We verily believe that so far from the practice being known to workmen of "scamping" their work, as the modern phrase puts it, the very name was unknown in the old times we have referred to.

That we are right in this view of the matter, some considerable experience as to what has been done in the way of making old buildings look and be as good as new ones abundantly proves. The strictest examination of such will show that, although in many cases parts are in bad repair, such as the walls, floor or roof, taking these as a whole they will stand comparison with even the best of modern work, and are far before, in real constructive work, the second class and lower classes of this. Few walls are built nowadays of the true solidity throughout which characterised those of generations back. The same may be said of the interior wood-work, the quality of the timber being generally first-class, and the fitting together, although in one sense roughly, is thoroughly done in a workmanlike manner, to which we do not always find a parallel in modern times. These are, therefore, good materials to work upon as a basis, and when the dust, dirt, and the results of accumulated damp are removed, the proprietor will not be a little surprised at their value. How to use the materials thus obtained does not come within the scope of the present work. This will be known either to the agent or the bailiff, or, failing the necessary knowledge on their part, as a matter of course to the professional architect, who may be employed for work of this kind on the estate, to whom also will probably be entrusted the duty of drawing up the plans of the new cottages required, this being the last head of our subject.

To do full justice to it, larger space, indeed, than that of the present volume would be necessary. We can obviously, therefore, merely treat of the leading points. In the first place, all the cottages should not be similar in point of extent of accommodation, although precisely so as regards design and style of fitting exterior and interior, which will economise greatly their construction, each part being a duplicate in one cottage of a similar part in another. As houses vary in size in towns to meet the necessities of families, some with no, some with many children, it is difficult to see why this common-sense principle does not apply to rural districts. Its overlooking or wilful neglect has done much to retard the giving of new and good cottages, inasmuch as the unnecessary expense involved caused others to hesitate at the outlay. So, also acting in this direction, did neglect of another principle in cottage designing, that is, that accommodation not required for the labourer, not used by him when he gets it, and not at all wished for by him, should not be given—a parlour, for example, is never or rarely entered either *by him or* by any of his family. In brief, the point to *be considered* in designing the cottages of the estate is *simply what* are likely to be the average claims or requirements of its labourers in the matter of accommodation; this being fairly concluded upon—and, of course, much of the decision arrived at will be chance work, which cannot be avoided—no more should be given; but what is given should be such as to allow of health being maintained, decency, order, and convenience in living promoted. These comprise nearly all the points to be thought of, how they are to be prudently carried out does not come within the scope of this work. But it is scarcely necessary to say, that while we strongly advocate the above principles, we would as strongly deprecate the practice of giving cottages with only one room. This in one sense might be made healthy enough so far as good construction went, but it could never be truly so, and by no possibility could the conveniencies of life be carried on in it. Having now described the farm buildings proper, we proceed to notice what may be called the outlying works of the farm, some of which closely cluster round, and others are more or less distant from them. Some of these, as fences, gates, and roads, we have already described, but those still remaining, as ponds, reservoirs for stowage of water, embankments on sea margins, and river works, we shall now proceed to notice.

Ponds.

Those are divisible into two classes as regards their position in the farm; the first class comprising those which may be called the "home or steading ponds," placed closely to the farm steading, the second being "field ponds," distant from the steading according to the locality of the fields. Taking the first class under *consideration*, it may be stated that their *condition is such*—we were about to say as a rule, bu certainly in vastly too large a number of cases—as is disgraceful to the cleanliness and order which ought to characterise all well-conducted farms, as the waters which they hold are prejudicial to the health and condition of the live stock which are unfortunately compelled to drink of them. If those connected with live stock who have such ponds on their farm, whether at the fold or in the field, but knew the influence bad water has upon them, they would not rest till they had put the ponds into a condition fit to hold pure water, and to keep it pure. The influence of water which may be thoroughly clean as regards external or visible contamination, being used as it is withdrawn from the well or taken from the spring, but which yet contains some impurities or deleterious constituents either chemically or mechanically combined with it, is often so bad that it should be the care of every agent of an estate to have an analysis made of all water supplied to farms, in order to be assured that some do not belong to this category. If this care be demanded, and this danger be incurred in the case of water so called clean, what must be the result of the use by live stock of water drawn from an open pond contaminated by the deposit of the particles of dust and dirt, both highly dangerous as a rule, blown into them from the road or the steading, by sewage water, liquid manure, or ditch drainings allowed to flow into them, either directly or by filtering through the soil, by decaying leaves, straw, and a host of other matters? The question need not be asked, but it is a pity that it ought so often to be put by farmers to themselves, but is nevertheless not put, so that matters are allowed to remain for years in the condition we have described. It is not enough, however, that ponds be from time to time cleaned out of their deposited mud and filth, and the water for some short time be clean or comparatively so; it is essential that it be kept pure and clean so long as live stock are permitted to drink it. This cannot be done in the great majority of cases without constructing them upon a plan essentially different from that so long acted upon, and still, as a rule, maintained. In place of having the enclosing sides and the bottom cut out of and retained as a soft porous soil, with perhaps, as in the best examples, a clay-puddled bottom, which might have been good at first as a retentive one, but which by years of poaching by the feet of stock and constant contact with the water is generally nearly useless, they should be carefully formed with a hard, unyielding, water-tight material. For this and for similar purposes, as well indeed for the foundation of floors of all kinds, and for the lining of water-tanks, liquid manure ditto, the best in the end, and indeed often at the beginning, cheapest material is Portland cement concrete. This can be made and laid down so as to fit any form or shape of receptacle, or upon any flat surface horizontal or vertical, by a common labourer after a few minutes' instruction and a few hours' practice, often, as we have seen indeed, without any practice at all, so simple are the details of its use. The cement must be of first-rate quality, of which the best test is its weight; this should not be less than 100 lbs., but better if from 105 to 110 lbs., per bushel. The ponds laid with this material will then be constructed on the best principle; all that is necessary being the frequent clearing out of the mud, &c., and washing thoroughly, and cleaning thereafter the surfaces all round before again admitting the water. As a rule, cattle are allowed to go into the ponds to drink. This should not be allowed, for, however well *kept clean, mud* more or less will be deposited in the bottom, and this being stirred up by their feet will surely render the water unhealthy; moreover, it is still more contaminated by the excreta often voided by the animals while in the water. The best way is, by an easy adjustment of the levels, to allow some of the water to flow into a smaller tank, well, or trough, placed at the side of the pond, out of which the animals drink.

Ponds are often sheltered from the sun heat to keep the water cool in summer, and from prevailing winds, by a sheltering belt of trees. The objection to the trees is that the leaves dropping off annually gradually fill up the bottom with a deep layer of decaying vegetable matter incessantly being stirred up with the feet of the cattle. To obviate this, the belt might be formed of evergreen in place of deciduous trees; or, if these be employed, those only having the leaves for a long period, such as the beech or the hornbeam. But where at the steading a good supply of water can be easily led by pipes to a convenient place, and in the fields springs availed of, troughs or small tanks are infinitely to be preferred to open ponds. These can also be sheltered from winds and shielded from the sun by being nearly wholly enclosed by a hornbeam fence, or by a beech-tree belt near to them.

Sources of Water Supply—Springs, Wells, Hillside Watershed, Reservoirs.

We have in a previous chapter briefly alluded to the importance of taking note, amongst the resources and capabilities of the property, of those connected with the supply of water for the various purposes of the farm. *This element* being essential in farm steadings, before *proceeding to* erect these, it is necessary to make sure that an abundant and constant supply of good water can be obtained without involving heavy or indeed much expense. Should this not be the case, it will be necessary to alter the proposed site to one where these advantages can be secured; and this should be done even if the site be perhaps not quite so good in some respects, as this will be a lesser evil than that of having a deficient or intermittent supply of water, or the water, even if abundant, of bad quality, unsuited for the healthy support of animal life. Some steadings are most favourably situated for obtaining water, as in their immediate neighbourhood springs may be met with, or wells may require to be sunk to so short a depth that the expense of each may be so little that several could be put down at different parts of the steading and general assemblage of buildings in the farmhouse and cottages, &c. The sources of water are pretty numerous, being open springs, rivulets, rivers, and wells; while in some cases a never-failing supply may be obtained for the buildings, and even for irrigation, at no great expense, from some small lake or tarn in the hill district at no great distance. These sources give, of course, water of various qualities, on which much might be said; but as the scope of our work does not admit of our giving these, neither of details connected with the work of well-sinking, we proceed to other parts of the subject, simply referring to the special work on the whole question of water supply forming one of the series of rudimentary treatises of which this forms a volume. Before, however, we pass on to a department which is so highly important that we purpose going into its consideration at some length, we must not forget to remind the reader that the roofs of all the buildings *should be provided* with gutters, or "roans," as they are called in the north, so that the rain-water may b collected and stored up. This is highly valuable fo domestic use in the farmhouse, and if properly kep the best possible for the live stock of the farm, bein the softest and purest we can obtain. It is kep sweetest and longest in underground tanks, althoug cisterns will do well enough if kept clean. The im portant subject referred to above, and to which we no come, is—

The Collecting and Storing up of the Surplus Wate Supply of the Property, and the Works connecte therewith.

In treating the general question of the water-suppl of the estate, we have briefly alluded to the importan of having the water of the best quality, from the infl ence which it exerts on the health of the live stock the farms to which it is supplied, and also upon th quality of the milk in the case of dairy farms. We ha also shown briefly how best and most economically th supply at command can be availed of for the vario purposes of the estate, as under the heads of Well Tanks, Pumps, and Ponds; and, further, have draw attention to the sources from which it is generally look for and obtained.

But of such vast importance is this subject, and frequently do great inconveniences, and, what is wors large and heavy pecuniary losses, arise from lac of supplies in times of drought, which a variety circumstances not likely soon or easy to be altered mal more frequent now than ever, that it behoves every o *connected* with the management of landed propert *to endea*vour to provide against all contingencies t availing themselves of sources of supply other than those generally and almost wholly relied upon now. That there is at least one source of supply—and that in the majority of instances almost unlimited—available on most properties, we hope in a sentence or two to be able to show.

As a rule, this taking up and using what may be called extra or supplementary supplies is almost universally neglected—a neglect arising we believe, however, very largely more from ignorance of the points of the subject than a wilful overlooking of the advantages which would arise from making those sources available. Water is at all times precious, and there have been few stock farmers—we question if there has been one—whose experience has extended over anything like a fair range of time, who has not found himself placed, in seasons of great and long-continued drought, in circumstances in which he would have given almost any price for it for the use of his cattle, &c.

It is not certainly every farm the locality of which offers those peculiarities which afford sources of water available by a judicious adaptation of means; but still there are an enormous number in which water, in times of excess and fair supply, is allowed to run to waste, which if stored up would be of immense value in times of drought. To a few of the methods by which these sources can be availed of we now propose to draw brief attention.

The class of land which obviously offers the greatest number and variety of sources of water is that which is hilly; the next, that which is called rolling land, in which, while there are many valleys, the slopes bounding their sides are not so precipitous, and the general character of which is, as in the hilly land, level. On hilly land farming is chiefly confined to pastoral, and on farms adapted to this practice or class of farming the buildings required are neither numerous nor large, nor, as a consequence of this, machinery either. It is on land where other classes of farming are practised, and markedly that of the mixed husbandry, on which, of necessity, there are large and numerous buildings, and in these is the machinery generally in use; and it is land of the second class which is adapted for those methods, and on which, and for which, the largest supplies of water are required. Further, it is a happy circumstance attendant upon land of this class that, while it affords many sources of water supply, the peculiar features of its face are such that these can be made use of in taking advantage of those sources. We thus see that all the circumstances connected with the second class of land we have named are happily adapted to the economical availing of those sources.

That water on a large farmery or farm steading can be employed for a much larger number of purposes, and in a greater variety of ways, than is generally thought, there can be no doubt in the minds of those who have given attention to the subject. By the use of simple mechanism, and often, indeed, in specially favourable cases, by natural means alone, as the power of gravitation, water can be supplied at pressure to any part of the building; so that it can be laid on to supply the whole range of live-stock houses, stables, &c., &c., thus saving a very large amount of labour in carrying water, and this is of course equivalent to the saving of money. In addition to this valuable service, it can be used for cleaning out the buildings, and, in cases of fire, it will obviously be extremely valuable. By using one or other of the many hydraulic machines in the market, machinery can be driven at any point required; thus either obviating, in the case of small farms, the necessity to put down a steam-engine, or, in the case of large farms, supplementing the power of that already supplied, thus giving power where none is at present used. These and other uses to which water can be applied will prove abundantly the importance of the subject to which we are now drawing the attention of the reader. One other use may here be alluded to before giving our further remarks, and that is irrigation and the watering of grass-fields in times of excessive drought.

In the localities to which we have alluded at the beginning of our remarks, as coming under lands of the second class, there are usually valleys or depressions of the land, more or less numerous and deep, or below the general level, and through which small streams flow, or down the sides of which watercourses, or "watersheds," are to be met with. In such cases the most economical, the readiest to hand, so to say, and the quickest mode of collecting the water, is to throw an embankment across the valley or depression in the land. Behind this the water collects, and in course of time a reservoir, of greater or less extent, is formed, from which a large supply of water can be obtained, and led off to any part desired. It may be said that by this plan a considerable extent of cultivable land, or land adapted for pasture, will be lost; but in the majority of cases it will be found that there are points in these valleys at which but a small proportion of such land is met with; and even if so, we maintain that, as a rule, the value of the reservoir formed will be much greater than that of the land taken away from the valley or depression to form it.

A careful inspection of the locality is to be advised before deciding upon the site of the proposed embankment; for it may be found, if this be not given, that after having begun the work a much better site could have been had. And it may, after all, be the cheapest plan in the end to call in at first the services of one skilled in such matters in order to inspect the locality, as experience goes a great deal in such matters; and to one who has it a single walk over the ground will enable him to decide upon the very best site, which to one less skilled, or not skilled at all, would not have been noticeable after days of search and "out-look." The farmer, however, if he is a man of "nous," will be able, from his knowledge of the lay of the land, and its watersheds, soon be able to pick out a position in the valley across which to throw the embankment which forms the reservoir.

One point we should counsel him upon is this: to try, if possible, to get such a position that good "butting," or resting-points, be got for the ends of the embankment to terminate at. Much of the safety, and also of the economy, of construction of the embankment depends upon the way its ends join the sides of the valley, and the steeper those are at those points the firmer the embankment is made.

Another point to be observed is, that as we suppose the work to be done is to be done as "home-work," that is, by the ordinary labour of the farm, without the employment of a professional engineer, the simpler the character of the work arranged to be done the better. Now, short or small and shallow or low embankments are much more easily made, and their safety much more to be relied upon, than large and high ones. It should therefore be the aim of the farmer, if the nature of the locality will admit of it, to arrange for a series of small embankments, forming a network, so to say, of reservoirs, the connection between which can be very easily made by the drain-tubes now so readily and cheaply obtainable. This succession or multiplication of small reservoirs need not be necessary where the supply of water required is not great; but where it is, the plan here recommended will be safer, and more cheaply carried out, than where a large embankment is necessitated. It has other advantages also, which will be obvious on consideration; thus, for example, if the water be used for irrigation purposes the small embankments may be made at such points as will enable supplies of water to be given to different fields. We merely advert in a general way to these various points by way of indicating how, by some thought and consideration being given to the varied work of the farm, no matter in what department, many advantages may be obtained.

Embankments for Enclosed Lands on the Margin of the Sea, or of Tidal Rivers.

As this subject is fully treated of in a special work (the "Practice of Embanking Lands from the Sea," by T. Wiggins, F.G.S.), in the series of which this volume forms a part, we refer the reader to this for ample details on all points. It will be sufficient for our purpose if we only glance briefly at the leading points to be observed.

The first and most obvious point is whether the soil of the part proposed to be reclaimed will, when cultivated, repay the cost of the operations. It is not, as some think, the case that all lands partially under the sea—or as in *some cases* in certain states of the tide, *and in other cases* with every tide, wholly so—are fitted for paying cultivation. The best soil is an argillaceous one; the worst, the black, oozy, muddy sand, which contains chiefly but decaying organic matter and pure sand, and few or none of the constituents of fertilising soil so essential to ultimate success (see "Cultivation of Different Soils," in next chapter). A good indication of a fine rich soil, which will be most likely to pay the cost of its enclosing, is the growth of the marine plant the samphire on parts which first more or less become solid. This is the earliest vegetation which appears, and is the forerunner of the grasses which in time spring up and afford a good bite for sheep. The soil in such cases is an argillaceous one generally, and should be so to come under the first class. The second class is the silty loam or earth on which rough sheep-feed grows. The third, the mudbanks on which samphire grows, these being under water at spring tides; the first class being above or at higher levels than these, and therefore only overflowed by unusually high tides. The fourth class is the muddy banks under water at all tides, and exposed only at low water; the value of the soil of these depend upon its proportion of argillaceous matter. The fifth class is pure or "sheer sand;" this being rendered fertile only by the presence of the detritus of shells or calcareous deposits, or may be rendered so by being mixed at its upper surface with the marl obtained from beds on which these sandy expanses usually lie. Mr. Wiggins recommends the soil to be taken up and put into boxes, to have experimental crops on a small scale made in them. And, as a rule, it may be noted that the character of the soil of the lands proposed to be *enclosed* may be gathered from that of the adjoining *lands under* cultivation, those having been at one time *but a continuation* of the lands yet unused. Shells in any soil, or where it is largely mixed with their detritus, are a sure sign of fertility. As shingle, gravel, good sharp sand, small stones, &c., are exceedingly useful for repairing roads, &c., &c., should banks of these here and there be met with they may be enclosed at a profit. The next point is to see that there be height enough of the land sufficient to give such a fall or height above average low-water level that the sluices will have the water running through them for at least from four to six hours a day from tide to tide. In Essex, where there are vast tracts of land enclosed from the sea by embankments, the low-lying lands are rarely thought worthy to be reclaimed, only indeed those parts which have "saltings," and which are, as a rule, covered by spring tides only; the sea-walls are placed on ground, on an average, five or six feet above low-water level, and are comparatively low, rarely exceeding eight feet in height. Another point to be borne in mind is that the land to be enclosed will be more easily brought under cultivation if its surface be not a dead level, but rather undulating, so that inclined surfaces will be met with here and there which will greatly facilitate the flow of the surface waters of rainfall into the ditches and drains, &c. Lands very much above the level of high water are usually too much cut up by fresh-water channels and rills, which cause great expense in levelling, &c., &c.

It need scarcely be said that an essential point to be considered is the nature of the soil at the line of proposed embankment, so that as secure a foundation for it may be obtained as is possible. Where the embankment encircles the bend or curve of a wide reach of water, open and exposed to the prevailing winds, which cause a continual or frequent dash of water against the bank at its weakest parts, unusual care will have to be taken in this respect, as well as in the various details of its construction. And it will be a great security to the bank if the opposite side of the reach be sheltered from the winds by rising ground, plantations, or belts of trees. Should the lands proposed to be enclosed be in the neighbourhood of high lands, from which vast quantities of drainage water are shed down, it should be remembered that this condition will involve no small expense in providing means to catch these waters outside the enclosed area, so as to carry them direct to the sea. And if the area be intersected by rivulets or rivers of rapid flow, which bring down detritus of *infertile* substances, then the land will be gradually reduced in value by having this deposited over its surface through various causes.

The site, then, of the enclosed area being determined upon, the proceedings as regards the work of enclosing will be very much of the same nature as elsewhere described in warping land on the large scale, those comprising the building of the embankment, the cutting of the interior delph or inner drain, the footing of the embankment seaward, the sluices and gates (in many cases now the surplus water is drained off from the delph to the sea by means of the ordinary drain-tubes, of earthenware, with a simple valve at each end; this form of outlet we have adopted with economy and success), and finally the cutting of the subsidiary drains over the surface of the enclosed land, or "intake," as it is technically termed. We need scarcely say that all the work requires to be done with the utmost care, more especially that connected with the embankment, which is to the whole what the backbone is to a vertebrate animal—the main source of its strength and safety.

It does not form part of the scope of the present outline volume to enter into details of construction of embankments, but it will, perhaps, be as well to give here a few notes on the subject, referring the reader to the work by Mr. Wiggins in this series, on embanking lands from the sea, for fuller information, in which will be found also much matter referring to embanking work generally, such as that for reservoirs treated of in a preceding section.

1st. *The main bank*, built to the full height of ordinary spring tides, which is taken by way of example at 10 feet. It is 20 feet wide at top, and with a slope to sea side, partly of 5 feet base, and partly of 4 feet base, to 1 perpendicular, as the minimum slopes.

2nd. *The outburst bank*, 5 feet high and 8 feet wide at top, and with a slope of but 1½ to 1, because this part of the bank will have to sustain but a transient stress from the top of the tide, and this only occasionally. On this is set

3rd. *The swash bank*, which, having only to sustain the broken tops of the waves, is but 2½ feet high and 2½ feet wide at top, though its base is 8 feet, and should be made amply sufficient to prevent any part of the highest seas going over the bank.

The construction of the diagram, Fig. 14, is as follows:—

Having drawn the base line *a b*, construct the cubes *d* and *c m*; draw *a c′*, 5 base to 1 perpendicular. Set off 6 feet from the top of the cube *d* towards the base line, for the high-tide wave. Draw the line *d s*, intersecting *a c′* at *s*. Draw *a s* and *s m* and *h b*, and this completes the *main bank*, with the double cubes of its height backed by a half-cube, besides the front with a base of 4 to 1, the gravel footing bringing it 5 to 1. *For the other proportions* construct the cubes *e* and *f*,

SECTIONAL DIAGRAM OF SEA BANK.

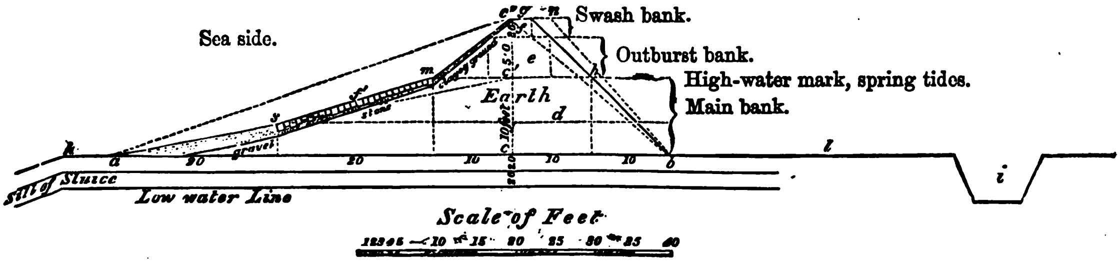


Fig. 14.

and draw *m c''*, also *g* and *g h*, giving ample weight, substance, and slope to the bank for ordinary cases.

The rationale of this construction will appear as we go on, but its outlines are these. The cubes *d* and *c m*, with the half-cube *b h*, are considered to be very ample for the body of the *main bank*, which is 20 feet wide at top. The slope of 5 to 1 is lessened at *m* to 4 to 1, in order to afford a greater base for the upper bank, and because the space from *m* to *s* is stone-faced, that space being 6 feet perpendicular from the top of the main bank, which is considered to be the usual height of great waves near the shore. The gravelled footing is on the slope of 5 to 1, and is not stone-faced, because the sea has not acquired much force at that height of tide. This completes the main bank. The *outburst* and *swash banks* are drawn with a narrow apex in order to give as much slope as possible to the line *m c''*, but where the soil is tenacious, this line may retire still more, and the line *g b* may be steeper.

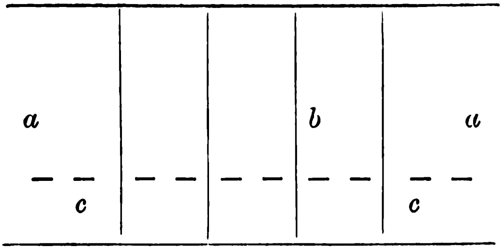
The essential features of the bank recommended and illustrated in Fig. 14 are the following: *a b* is the seat of the bank, or base on which it stands; *a c''* is the slope; *c c' c''* is the height; *d e f* is the thickness; *f* is the facing; *g* is the top; *h* is the back; *i* is the "delph;" *k* is the foreland; *l* is a gravelled footing on both sides.

River Bank Works.

The importance of attending to the condition of the banks of rivers may be gathered from the fact that in some instances the cost of the repairs necessitated through neglect or defective work exceed the yearly rent. Works of this kind may be resolved into two *classes: first,* the protection of the banks from the action of the river; second, the raising of banks to prevent the flooding of adjacent lands.

Where rivers run through long stretches of alluvial soil, and contain much mud or silty matter, which they deposit more or less quickly in proportion to the rapidity of the stream, great care is necessary in the management of the banks to prevent two things mainly, those being the washing away of the materials at the foot of the banks, or of such embanking or enclosing walls as may be placed at certain points; and, second, the deposit of masses of mud which form banks at wrong or dangerous points. These banks are indeed the cause frequently of the first evil above named, as from their position relative to the flow of the river they deflect the stream or currents against the foot of the opposite bank. Where the banks are soft, and liable to be washed away by the river or by currents having formed, there are various modes of protecting them in use: as stone facing with piles driven at intervals, and a row of footing piles at the "toe" of the bank; or fascines, or bundles of brushwood, are used; or thorns tied down with pins to piles driven in at intervals. If the banks be low and pretty vertical, the water face is sometimes lined with wicker-work pinned into the bank. But these, although effective enough in some instances, are quite or almost useless in others, as they fail to protect the part which is usually acted on by the current, namely, the underpart, or toe, of the bank; so that where this is underwashed the upper part is sure to fall in more or less, bringing down with it such covering as may have been used upon it. In such cases the first object is to arrest the currents, so to say, and cause *them to yield* up their mud or silt, and deposit it on the *bank. Taking* advantage of this principle, a Mr. Poole, who describes his plan in the *Royal Agricultural Society's Journal*, adopted a method of trenching-in stout hedges of dead thorns into the face of the bank from top to bottom, or from high- to low-water mark in a tidal river. These ran at right angles to the line or face of bank, and were "trenched into the bank."

"In cases where the bank was very steep, it was necessary to trench in another line parallel to the stream, as the line *c c*. This was placed at low-water mark, and connected the rows *b b* together, and prevented the mud which was collected between the rows from dropping into the river. It is essential," says Mr. Poole, "to the success of this plan, that the thorns should be at least 7 feet in length, and that any hedge that is made parallel with the stream should be as low down the bank as possible, for if placed on the steep side of the bank it will frequently be unable to support the weight of mud which will accumulate upon it. I have now tried this system long enough to satisfy myself that it collects the mud more rapidly, and is infinitely cheaper, than any other system which has been tried on this river. The apparent slightness of the material, and its perishable nature, may at first sight be considered objections, but they are not so. I have never known these hedges washed away; the rapid



collection of mud effectually secures them; and the only injury they are likely to receive is from a ship occasionally making a gap in them in passing up or down the river. This, however, is easily repaired. The material also will not decay before it has effected its purpose."

In some rivers, where the banks are not so soft and yielding as in those passing through alluvial land, an erosive action nevertheless often goes on which is brought into existence through the agency of a current deflected from the opposite bank, or where sudden curves and changes in the direction of the river's flow are met with. Such cases are very simply dealt with in some instances; in others the work is both tedious and costly, more especially where, as in hilly or mountainous districts, the river has its channel very much inclined, and where "freshets," or sudden floods, take place. The banks of rivers thus exposed to the washing-away influences of currents, however caused, are generally protected by stone facing and piling, sometimes with a timber facing of planks or battens, or partly of timber balks laid out in squares or rectangles and the spaces between filled in with squared blocks of stone, or merely with rubble or dressed rubble-work. The great object of the engineer in all cases is so to arrange the works on both banks that the stream shall be kept as nearly in the centre of the river as possible, so as to avoid all lateral deflections of the current, which are the chief cause of the destruction of river banks of the class we are now treating. This requires, and can only be decided upon by a careful study of the locality, and the "behaviour" of the river under as varied a series of circumstances as possible.

Where lands are liable to be flooded by rapid rise of rivers, the only way to secure immunity from this great source of loss is banking or embanking the river margin. The work to be done under this head so closely resembles in its principles and details that for reservoirs and sea walls, that we have only here to refer the reader to our remarks on these for further information. The great aim, however, we may here say, is so to place the bank and form its inner or river side, that the water will roll over the surface with as little rubbing or erosive action as possible, to attain which the outline should be as free from sudden curves or bends as possible—even sacrificing a little good land riverwards to get a long easy sweep—the surface be smooth and uniform, free from knobs and depressions, and with a slope riverwards say of 1 foot perpendicular to 3 feet horizontal: landwards the slope may be 1 to 1½ feet.

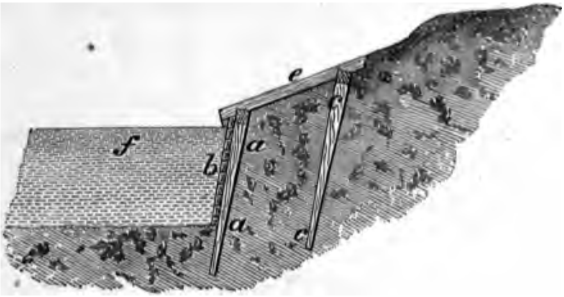


Fig. 15.

In Fig. 15 we give an illustration showing how the bank of a river may be protected by piling and beams, placed so as to form compartments on the face of the embankments, as in Fig. 16. In Fig. 16 these compartments are shown—some being shown as being filled in *with stones, as e;* some with gravel, as at *f*; and others, where the circumstances of the case will permit of it, with concrete, as at *g*. The sizes of the compartments may vary according to circumstances from the square, as *c c*, to the rectangular, as *d d*. The timbers *a a* run parallel to the line of stream or along the face of the bank; the timbers *b b*, at right angles to these, being spiked on to the tops of the piles *a a*, *c c*, Fig. 15, *e* in this figure corresponding to one of the timbers, *b b*, Fig. 16.

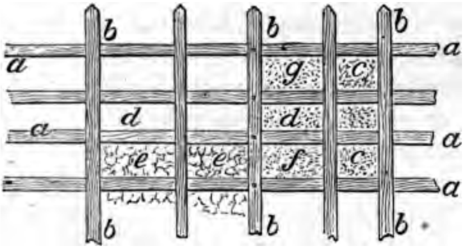


Fig. 16.

Irrigation of Land.

Where there is an abundant supply of water, and the soil is well adapted to be improved by irrigation, and where other circumstances are favourable, it may be deemed advisable to lay out some part of the land to be irrigated. As in the case of embanking lands from the sea, so this subject is specially treated of in a volume belonging to this series (volume v. of "Outlines of Modern Farming)." We shall here only give the leading points of it, referring the reader for more fully detailed information to the above-named volume.

The first point to be noted in considering the eligibility of the land proposed to be irrigated is its locality and general features, as much of the cost of preparing it depends upon these. The land which requires the least expenditure is that on the sides of hilly land growing fair crops of ordinary hillside grass, and on the upper side of which there may either be a natural rivulet or stream flowing in a general direction at right angles to the line of descent of the land, or a large-enough supply of surface or other water sufficient to fill a watercourse; or this course, or "main carrier" or feeder, may have its locality so arranged with reference to a neighbouring river or stream that it may be supplied from this. On lands of this kind the "catch-water system" is adopted, of which the following is a brief description. Supposing *a* in the annexed diagram (Fig. 17) to represent the section of the stream or the "main carrier" above alluded to, this running along at the upper side or boundary of the hillside which slopes from *a* to *g*, and flows in the direction of from *a* to *a'* in the second annexed diagram (Fig. 18). At some distance on the side of the incline a small drain or gutter, *c*, is cut, running parallel, or nearly so, to the drain *a*; at some distance below this another gutter is cut, as at *e*, and below this, say, a third, e. Now if *we suppose the stream a* to be dammed or sluiced up at

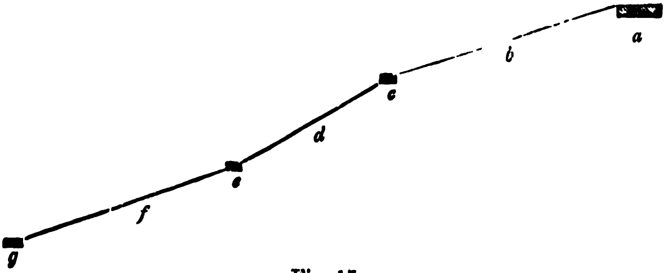


Fig. 17.

one point, so as to cause it to overflow, the water will run down or be shed over the surface of the ground behind the drain *c*, and the stream *a*, as the part *b*. In the same way by overflowing the gutter *c*, the water will be shed over the inclined part *d*, and delivered to the gutter *e*, from thence over *f* to the final gutter *g*. In place of the flowing source of supply at *a* being a river or streamlet, this may be made a feeder or "main carrier" as it is called, having *its* source of supply from a neighbouring river or stream. The main carrier should have a fall throughout its length of at least two inches in every drain, and the width be at least 18 inches, and the depth 8 inches. The small carriers or subsidiary drains, as *c e*, Fig. 18, are level in the direction of their length, and this necessitates the exercise of no small degree of skill on the part of those who lay out the land; for as the contour of the land will in almost every instance be continually varying, the level of the land will also be varying, so that the gutter must be made to meet this varying level. Few lands will be met with, for instance, where the gutter *c c* will run parallel with the gutter *a a'*. The skill of the irrigator is sure, therefore, to be called into account in keeping the gutters, as *c c*, *e e*, perfectly

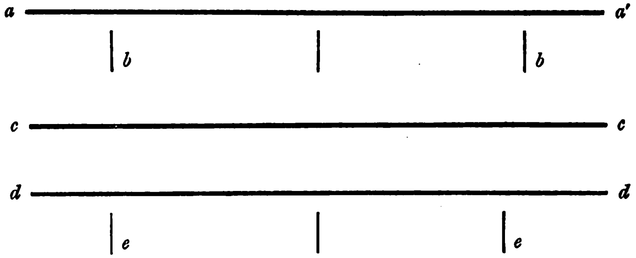


Fig. 18.

level throughout their length, however varying may be the surface of the ground. The distance between the gutters, or the breadth of the surfaces between them to be irrigated, varies from 20 to 40 feet.

Where the locality of the land is either at the foot of hilly land, as in the case of boggy or marshy soils, or elsewhere, as on the banks of a river, but in either case where it is nearly level throughout its surface, the mode of preparing the land is that known as the "bed work," or "ridge and furrow" system. This is illustrated in the following page illustration.

The land is laid out in a series of ridges, *a a*, Fig. 20, along the top of which the irrigating channels *b b* are led, and from which the water flows over the sides; being taken up by the drains *c c*, placed between and at the lower parts of the sides *a a*. In Fig. 19, the plan, the same letters are used, the main feeder being shown at *d d*, and the channel *e e* leading off the waters after they are used for irrigating. The following are the general dimensions. The breadth of the ridge *a*, from side to side, varies from 30 to 40 feet, that is, each side slope is from 15 to 20 feet wide; the length from 75 to 90 and even up to 200 feet, according to circumstances. The ridge should be finished at the ends with slopes, as shown at *a a*, Fig. 21; the slope being of the same angle as the slope of the sides *a a*, Fig. 20. This will vary according to circumstances, 1 inch of a vertical rise for every foot will be a good horizontal rise in ordinary circumstances. The width of the upper end of the channels *b b*, Figs. 19 and 20, where they join the main feeder *d d*, Fig. 19, should be 2 feet, at the lower end 18 inches. This construction is made in order to cause the water to flow over the edges of the channel to the *side slopes a a*. The depth of the channel b b, Fig. 20,

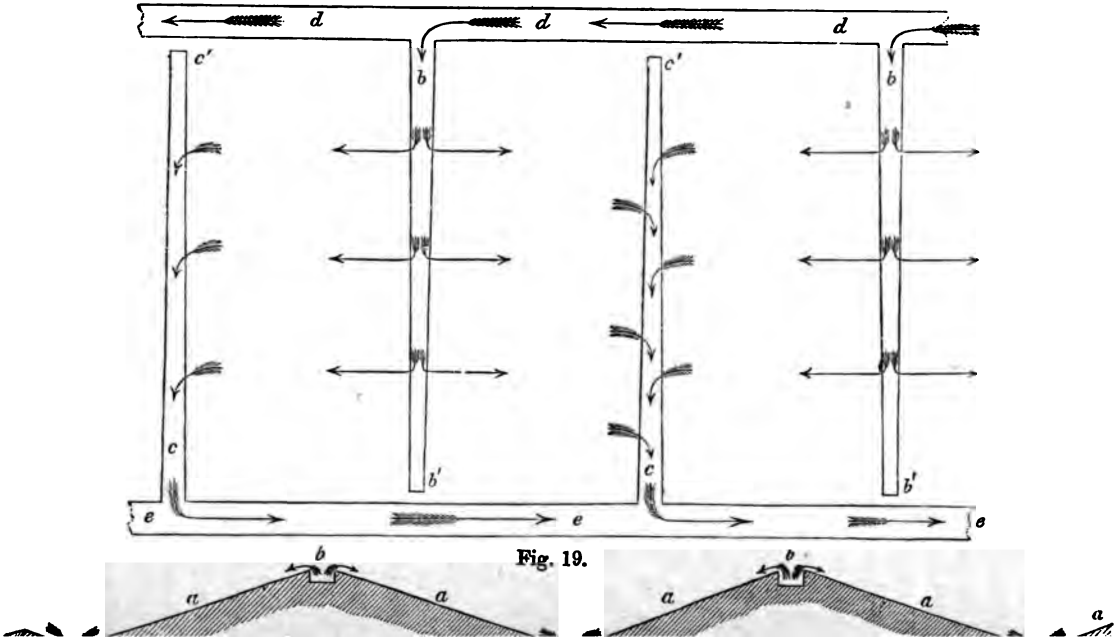


Fig. 19.

at the end nearest the main feeder *d d*, is 9 inches, at the farthest end 12 inches; this gives the required fall throughout its length. The dimensions of the catch drains *c c* are the same as the channels *b b*, but their positions are reversed, the narrowest end being nearest the main feeder *d d*, Fig. 19, the broadest near the drains *e e*.

A great deal of the economy of work of this kind depends upon the way in which the engineer takes advantage of the natural features of the land, so that the excess of one part may make up for the deficiencies of the other; and in some cases the local features may be such that part may be laid out on the "bed," the other on the "catch-water" system.

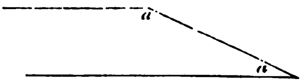


Fig. 21.

The next point to be considered before deciding upon irrigation is the quality of the soil. The best soil is that which is capable of absorbing a large quantity of water freely, yet so retentive as to keep it present amongst its particles for some time, those particles containing such constituents as analysis may show will have a capability to combine with the fertilising properties of the water, or with such fertilising ingredients as it may contain. An authority gives the first place to "sandy," the second to "argillaceous," and the third to "marshy" or boggy soils. Of the first, the best is a clayey sand, warm, dry, of fine grain, and with a portion of marl in it; it is equally or nearly as good if a portion of humus be present. Of the second, the extremes lie between a moderately heavy open and a dense, close, retentive soil; the latter presents great *difficulties in irrigation*. Of the third, it is only by careful working and time that good results can be obtained; still where these are given this class of soil abundantly repays the cost of laying down the works.

The last point to be considered is the quality of the water itself used or proposed to be used for irrigation. The best is that in or near which watercress, the aquatic ranunculus, and the speedwells grow; the second quality is that favourable to the growth of the insects *Sium cutifolium* and *Sium augustifolium;* and the worst is that in which or near which the mosses and sedges luxuriate. The *soil over which the water flows* exercises a decided influence upon its quality. If flowing over a marly soil, or rising through thick beds of sand, the water is good; so also the drainage water from low marshy lands, of which the subsoil is good, is also a fairly valuable irrigating water, whilst that coming from peaty, boggy lands is decidedly bad. The water shed from hilly grounds with bare stony surfaces *is bad,* while that flowing over grassy slopes is good. *Lake* water with sandy margins, and on the banks or

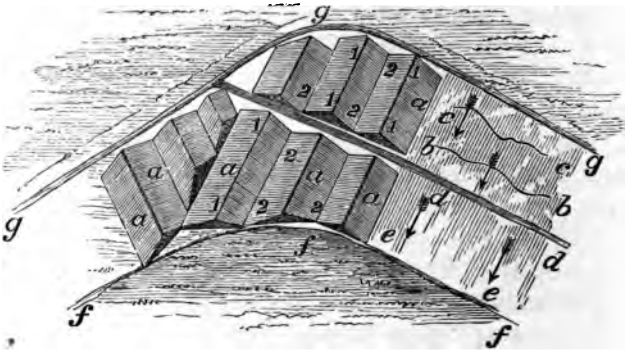


Fig. 22.

margins of which rushes and reeds are abundant, should not be used for irrigating purposes. All waters are best which have a high temperature, and all are improved by being exposed to the air, so much so that even that from boggy or peaty soils may be beneficially used if it flows a long distance before being applied to the soil. In conclusion, all lands under irrigation require to be drained in order to obtain the highest productive effects. This may seem a strange thing to insist upon in the case of lands placed under water, but

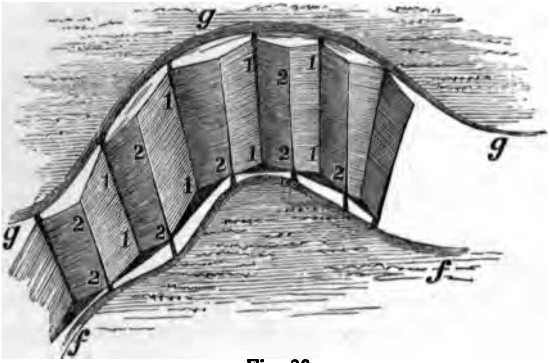


Fig. 23.

it must be recollected that the water is only "on" for a comparatively limited part of the year, and that there are intervals of time during which the grass grows under precisely the same circumstances as ordinary crops where drainage is essential. In Figs. 22 and 23 we give two diagrams showing methods of laying out fields with curved outlines, and the way in which these influence the fences (see paragraph on Fencing) where irrigation is adopted. In Fig. 22 the parts *a a*, *and in Fig. 23 the* whole surface, is laid out on the " ridge and furrow" system, those being best shaped or formed for this style of adapting the surface of the ground to irrigating purposes. In Fig. 22 the part of the field to the left being of a more pronounced character as regards its slope or inclination, this part, *b b*, may be irrigated on the "catch-water" system, *c c* representing the parallel open drains. The field may have its lower parts in one uniform slope leading to the lower water-carrier *f f*, this being irrigated by a gently flowing watershed from the central carrier *d*. In the ridge and furrow compartments the channels carrying the water along the tops of the compartments from the upper water-channel *g g* are indicated by the figures 1 1, 1 1, while those carrying off the water which has been shed from either side of compartment, and are at the lower parts of these, are indicated by the figures 2 2.

Plantations,

whether set down in comparatively narrow belts or strips as a means for providing shelter to arable land exposed to severe and strong winds, or for the profit they yield in process of time to the proprietor when put down over large tracts of land, ought to form an important part of the work of the estate. Viewed in the latter aspect, indeed, they are highly profitable, for tracts of land which, either from their position, character, or from the poorness of their soil, could not be made to produce crops of any kind, may, by a fair degree of attention, and by an outlay in the way of preparation of no great amount, be made to grow timber to a large extent, which will yield a fair return—indeed, all things considered, a handsome one. And in some classes of soils a double benefit is obtainable by planting, inasmuch as these are gradually improved by the growth of the timber, and the care more or less which is given to it; for it may be taken as an axiom that land growing some kind of crop, looked after however poorly, becomes improved in value, and does not deteriorate or remain bad as when left waste, and allowed to remain so. There is thus something compensatory in all farm labour, small in amount as that may be.

The value of plantations for exposed parts of fields cannot be over-estimated. They are specially valuable to pasture lands. Much depends upon the way, however, they are planted for this and other purposes. If in large and heavy allotments, the benefits they are supposed to give will be greatly lost. The best mode of distribution for such purposes of shelter is in comparatively narrow strips, these placed, if possible, upon the elevated parts of the property. It is surprising how much shelter is afforded even by a strip of a few trees in breadth if properly disposed. Of course it is different with plantations set for the purposes of home-timber growth, of which we shall have hereafter remarks to offer; but for the purposes of shelter heavy thick clumps in large measure defeat their own object, and where used to shelter fields under cultivation more especially so. For in such cases, while they do in a measure protect them from biting blasts, they also prevent the access of light and air, both essential requisites to successful cropping, as we have elsewhere shown. The position of the wood, as already hinted at, is also an important point to be attended to. Some pay so little attention to this, or are, perhaps, so ignorant of its value, that with them it seems enough if the wood be put down, that apparently being the great point, but where and how put is not at all thought of. Of course—and it seems scarcely necessary to draw attention to that point—it is essential to plant the protecting strips at the parts from which the prevailing winds of a cold and heavy blustering character come.

It does not, however, always follow that what is considered generally to be a mild warmish wind is so, or that its effects are favourable upon vegetation. Cases are known and might be cited where the winds—as, for example, east and north-east, universally supposed to be most unfavourable to vegetation, pasture, and arable land alike—have been proved, beyond a doubt, to be actually favourable to it, certainly not at all prejudicial. It will not be amiss, then, for a proprietor or his manager, who may be new to the estate and its history, while contemplating improvements in the way of plantations, to inquire into the history of the estate, and not in fact to be above the position of asking those who know of it as to certain facts connected with its local and other peculiarities. Such information so gained will be of great practical value.

The kinds or varieties of trees to grow for shelter purposes will depend upon circumstances of soil. But, as a rule, those best adapted to resist strong winds are the following. The mountain ash, known in Scotland as the rowan-tree, and it makes also a lovely addition to shelter plantations on fields not far from the house, as in spring the blossoms are beautiful to look at, and redolent with the finest perfume, while, later on, the changing hues of the berries contrasted with the green leaves, till they assume the deep red or scarlet so well known, make it a universal favourite. The sycamore, known also in Scotland as the plane-tree; the horse-chestnut, a lovely tree with its gorgeous spikes of blossom in spring; and, lastly, the various pines. One or more of those should generally be placed to the windward side of the shelter plantation, and the body made up with a variety of them or of other trees which take well to the particular soil. The depth or breadth of the plantation should vary with the climate, but a fair average one will be from 40 to 60 yards. Yet it is worthy of notice that depth or breadth does not always secure immunity from the force of the blast. Indeed it is surprising the degree of shelter which will be obtained from a fence of only moderate thickness, say of hornbeam—often mistaken for beech, which, indeed, it closely resembles. This forms a capital shelter all the year round, for the leaves, like those of the beech, being resinous at their stalks, and keeping long from decay and dropping off, remain to stay the force of the wind during the season when it is fiercest and coldest.

When we come to consider the growth of timber for paying purposes, we shall of course more specially point out what here we only merely allude to, and that is the necessity to grow timber adapted to the soil—a point apparently not likely to be lost sight of, but one which is pretty often so, nevertheless, to the complete throwing away of the purposes in view, at least to a great extent; for it is quite obvious that there must be some soils better adapted to grow certain trees than other soils. But it at the same time should be remembered that, although a soil be well adapted to grow a certain class of timber, it will not be a plan yielding the best results if, after cutting down a plantation which has succeeded well on a piece of land, to plant the same land with the same class of trees, as they will not be so valuable. In fact, the principle is the same *in kind, though not* in degree—for its action at all events is not likely to be so marked, considering the difference between the styles of cultivation—as growing two corn or two crops of the same kind in succession. In plantation work the principle of rotation of crops, avoiding this succession, is not much thought of, but why it should be so it is difficult to see, so far as its scientific accuracy is concerned. In practice the point is generally decided simply by the consideration as what kind of timber will pay best to put down upon the land. In very high lands it is of course absolutely necessary to consider the kind of timber best adapted to given heights, as each tree has what may be called its line of thriving height, above which, if planted, it will be poor and stunted.

This principle of rotation, or changing of the kinds or varieties of trees put down on land, would, however, at first sight, seem to run counter to the plan which good authorities seem to think the best in setting down timber, and which proceeds upon the principle that mixed plantations pay much better than those made up of one class chiefly of trees. Yet, by a judicious mode of working, the rotation even in such cases may be carried out at the time of thinning. By putting down a variety of trees, not only is variety of appearance secured, but of shelter also—those which keep their leafage on for a longer period than others giving shelter at periods when most required, as the beech, the hornbeam, and some of the oaks. Again, a variety of kinds yield a variety of shade, as some have their growth higher up than that of others; while the more tender and valuable trees can be protected by the more hardy and less valuable, care being taken to have the protecting trees well *established* in growth before the more valuable ones *are planted.* All these are points to which attention must be paid if the most is to be made out of the timber of the estate; and that it is a source of profit if well managed need not be named here.

There are various methods in use for laying out plantations of trees for the purpose of growing timber for selling purposes. The plantations are generally laid down so as to form shelter to the agricultural lands, or to serve some other useful purposes, as well as merely raising the timber. Where they are but of comparatively small proportions—mere strips, as it were, in no way approaching to the great stretches which cover hundreds of acres, and coming up to somewhat of the dignity of "forests"—the form or outline of the plantation undoubtedly the best to afford the greatest amount of protection against winds is the curved. We do not mean an outline with one unbroken sweep of curve—an arc of a circle—but a combined curved line; in other words, a waved curve or line, somewhat like the well-known "line of beauty" of Hogarth. This kind of line has a wonderful effect in breaking more particularly the force of a wind which may come sweeping along in the direction of its length, reducing at the various curves what would be blasts almost impossible to stand against, to currents of comparatively feeble strength. And even when the wind is in a direction at right angles to the length of the plantation, and therefore to that of the waved curve forming its outline, the projecting or convex parts of the curves break the force of the wind, meeting it first, and causing it to sweep with comparatively gentle force down and along the inlying or concave parts along which it sweeps, breaking again on the next projection. The best proof of the value of waved outlines *is the* preference invariably shown by *animals to plantations* formed with them, as compared with those with straight outlines, and the love they have for the shelter of the concave parts more particularly. A wind seems sometimes and somehow to gather redoubled force as it careers along a straight line. These effects are more observable in walls than in plantations, but the principle holds good alike in both. Towards the cultivated land side, should the plantation be on one side only of the land under culture, it may be said that cultivating operations will be interfered with by those waved lines; but this will not in practice be found to be a very great difficulty, as the fields can be ploughed square up to the headlands, and the curves on the outside of these will be generally of pretty large lines, having a wide sweep. The advantages, however, of the waved outline will, as a rule, outweigh any disadvantages of this kind. Where the cultivated land is wholly enclosed by sheltering plantations or by narrow strips of trees, the curves at the corners, if objected to as difficulties in ploughing, &c., may be dispensed with and the corners left square; but a large and an easy curve will be almost as easily ploughed round as an angle, and, as before said, the curve will be of pretty large radius. Plantations of an extensive kind have the trees, considered as a whole, arranged in form very much according to the nature of the land which they occupy. Generally they are in long stretches, unbroken in their length; sometimes breaks are found here and there, arising from some fault in the ground—the existence of a quarry, a piece of water, &c., &c. The trees, in place of being placed down irregularly on the land, should be put down on a certain plan, either in *rows or lines* parallel to one another, forming a series *of squares*. This arrangement is necessary not merely *to assist* the formation of the drains where these are necessary, but when the timber is thinned out the gaps are made more easily uniform—an important point, as the trees then grow up more uniformly all round, and do not throw out wood to one side more than another.

In large and regular plantations, walks, or what are technically known as "drives," are formed at certain parts, not only to gain access to the trees for the purpose of working round them, attending to the plants when young, and in thinning them out, but also to gain access from one part of the wood to another. These "drives" are usually formed in a very simple manner, having but little of the character of the ordinary roadway given to them. Where the soil is of close retentive clay, it will be well to form open drains at the sides, and to round the path off with the centre highest, so as to lead the water to the sides and prevent it stagnating on the surface; but if of a free or gravelly kind, they may be but a species of shallow open trenches, of width corresponding to the drive required, the main drives being of course broader, say with a breadth of from 8 to 10 feet, than the branch or subsidiary ones. In process of time they gradually become grass-grown on the surface, and left very much to themselves, being rarely repaired.

The planting of the trees, upon whatever plan carried out, is an operation which requires to be done with care. Before planting, however, the land must be drained if wet or if the soil be very retentive. Drains, as a rule, in plantations, are open ones, a prejudice being in favour of these, not only as the cheapest made, but because they are more easily kept open, the rootlets of the trees not being allowed access to them, closed drains on the ordinary agricultural system being supposed to be very liable to this accident. No doubt this is quite true, unless special means are taken to make the drains in such a way that the rootlets cannot gain access to the inside of the drains. That this can be done is without a doubt, by using collars or saddles, &c., &c.; still it is true that the cost and labour incurred are considerable, and it is therefore only under special circumstances that this work is likely to be undertaken. The open drains should, however, be carefully, not slovenly, formed; it is needless to say that their sides should be at such an angle as will prevent the soil from slipping into the drain; the "natural angle of declivity" of the soil will give a guide to this, but that of the sides of the drains should be, of course, greater than this. The bottom of the drain should be of regular declivity or slope, uniform in surface from end to end, no inequalities being allowed to interfere with the flow of the water, and the rate of inclination should be as great as can be obtained. The drains should be formed in dry summer weather, the season preceding that in which the land is to be planted. The "outfall" will be a ditch or rivulet, &c., at the lowest part of the plantation. That drainage is of as essential importance to the well-doing of trees as of any other vegetable growth is a point which need scarcely be here dwelt upon. The roots of trees descending into soil thoroughly saturated with water, which remains often in holes and cavities, in wet seasons sometimes approaching the condition of small wells, get rapidly into a state in which all healthy growth of the upper parts is impossible. The tree pines and dwindles, making no progress worth naming, and the roots and lower parts frequently rot, giving ocular evidences, if others were not present, that something is radically wrong. Drainage of plantation land, like that indeed used for other crops, is only for the removal of the water which remains and stagnates round and about the roots, not for that moisture which is essential in the soil for the healthy growth of the trees. It must, therefore, be carried out with judgment. (See Drainage Works.)

After the land has been drained, it must next be prepared for the reception of the young plants or trees, and the method of doing this depends upon the peculiar circumstances of the locality, position and altitude, soil, and general and special characteristics. Where the altitude is great, and the land, as it generally is in such situations, broken in surface and rough and uneven in special characteristics, the best must be made of the circumstances, for attempts at cultivation properly so called, in which implements are used, may be considered as out of the question. But at lower levels, and with surface of land more favourable, such as is not seldom met with, what may be called initial or rough culture may be attempted. In such cases the grubber will be found to be the best implement which can be employed, the plough being, as a rule, not available; but even in certain parts of such situations, from the character of the soil surface, grubbing may not be available either, so that, as in the higher altitudes, the trees must be planted on the natural surface in the best way available. Where favourable spots are met with, some previous preparation may be made before the plants are put in, which is done on what is called "pit" planting, "slit" planting being that adopted on the rough and high grounds above alluded to.

But on the low-lying lands, as in heathy land, where the surface soil is not full of stones and land-fast boulders, good work in preparing the land can be done *by the plough* and the grubber. Where the soil is very favourable, and spade-work available, the best results will be obtained by spade or fork trenching. In marshy lands so called, although some lands of this kind should scarcely be classed as such after being drained, the steam grubber or plough is the implement for doing the work, not only in the most effective way, but on the largest scale, and is the quickest and most economical. Of course it is only available, in a paying sense, where large tracts of land are to be put under plantation; but if one proprietor has not such tracts to plant, and other neighbouring proprietors have, by joining together they can avail themselves of the services of this wonderfully useful power at a rate which will be found truly economical. For an example of what steam can be made to do in reclaiming land, and making it available either for plantation or for general cultivation purposes, we refer the reader to the short account we give in another part of this volume of the work of reclamation now being done on the estates of the Duke of Sutherland. Where steam power is not, for one reason or another, to be used on the estate, the land of the kind now being considered must be worked either by manual labour—spade or fork work—in trenching and digging, or by horse-power in ploughing or grubbing. We confess, in the use of the latter power, to a great preference for the grubber over the plough in bringing land into good condition for planting. In cases where the land is covered pretty well with an undergrowth of small vegetation, this should be set fire to, and the ashes spread over the surface and dug, or ploughed, or grubbed in, as the case may be. This, if *not done* in the first instance, should be so in the case *of replanting* land from which the timber has been *removed.*

Fences.

Although treated of here, a work which precedes the draining and preparation of the soil is the fencing in of the plantation, so as to secure the trees from the ravages of cattle, &c., &c. Fences are formed in various ways and of various materials. In a district where stones are abundant, and where a number has been collected in the preparation of the soil, they will be of stone. These are generally, almost universally, of the class known as "dry stone" walls or "dykes." When built for the protection of plantations in which game is preserved, small port-holes or openings are left here and there, at the ground level, for the rabbits and hares to get through. The sides of plantation stone walls built in the regular way, and set in mortar, as those near the "policy" or park of the mansion, towards the plantation are left rough, only the outer side, next the pasture or cultivated land, being finished. There is no kind of fence so good and so cheap in the long run as stone walls or dykes, if well built at the first. Where the soil is good, and the expense can be borne, a "quick-set" fence or hedge, surmounting what is called a "sunk fence," that is, a raised mound of soil with the lowest elevation and smallest slope towards the plantation, and the reverse towards the outer side or the cultivated land, or that from which it is desired to keep out the cattle, &c., &c., is a capital fence. The outer side, towards the cultivated land, &c., being finished off with a deep and wide open drain or ditch, gives the name "sunk fence," or "ha-ha," to this form, as it is not observable till one comes quite close up to it, and nothing is seen, even at a short distance, but the high slope surmounted with *the hedge* or fence. The formation of the fence is a point to which considerable attention should be paid—the soil in which the "quicks," as the young plants are termed, being carefully prepared, deeply dug, and in the best work thoroughly drained. Till the quicks are well up, and the fence grown to be secure or strong enough to prevent cattle injuring it, they require to be protected by hurdles, or timber, or wire fences. Sunk fences, as a rule, are only used for plantations near the house or in the park grounds, where anything that is unsightly is to be avoided. In such places, as, indeed, for other localities, wire fences may be employed with advantage. They are "invisible" at a short distance, and are neat-looking when looked at near; they are also lasting if of galvanised wire, and are strong and easily erected.

For plantation in rough ground, or at a distance from the house, &c., and where other materials are not easily had, or cost much in carriage, very firm plantation fences may be made by using turf cut from the moorland. These will last a pretty long time if carefully made. The thinnings of plantations themselves may be used to form very economical and fairly durable strong fences, in conjunction with the dead wood of old quickset hedges, the timber being used in the form of stobs or stakes placed at intervals and firmly driven into the soil, generally at an angle to the ground, and at a short distance from the ditch, if any, the hedge wood being worked "in and out," interlacing between the stakes. This is sometimes called a "stake and rice fence." Thorns with branches of trees driven into the soil will also form a cheap and good fence, the thorns being well set in the ground, a trench being first cut to receive them. Home timber, as it is called, that is, the branches, &c., of trees from plantations on the estate, can also be used to form fences in the form of hurdles or rail fences. Larch thinnings form the best hurdles, and they can be easily made on the estate at the home-farm workshop, at which there is, or should be, a circular saw-mill for cutting up timber for various purposes.

To judge from the condition in which some plantations are, it would appear to be the opinion of their owners that the only thing to be done is the carrying out in its thorough simplicity of Sir Walter Scott's aphorism, "Aye be stickin' in a tree here and there; it will be growin' when you are sleepin'"—it not being thought necessary to do more than the "stickin in," as the growing will take care of itself. A very slight consideration will show, however, that trees, like all other vegetable growths, require management after being planted. One obvious part of this is the weeding and stirring of the soil between and round the young trees. This cannot always be done effectually, sometimes not very easily, at all, in the large tracts of plantation in the rough ground of elevated exposures; but where it can it ought to be done, even if only partially, where the soil and the situation are the most favourable for the work; but in lower situations, and with soil of a better quality, the weeding and stirring should be carried out as thoroughly as possible. Advantage might also be taken while at this work to see to the cleaning out of the drains. The *thinning out* of the young trees is a work of essential importance, as they choke one another, and cannot grow properly when they are allowed to grow as they list. Many a pound's worth of what would have been fine timber have been lost *through fear of* expending a few shillings in *thinning-out the trees.* Some proprietors, indeed, seem to have a great dislike to thinning—to getting rid of trees once they are planted. No policy can be worse than this.

The thinning time depends, of course, upon circumstances; under favourable ones it will, of course, require to be done earlier than under unfavourable. After all, the eye of the forester is the best judge or guide as to when the work should be done. When trees are seen to be overgrowing others, and causing unequal growth in them; when those of an earlier maturity, as the "nursing trees," in a mixed plantation, are seen fairly crowding down the later growing or hard-wood ones, and causing them to die out in great numbers; or whenever trees are seen to be growing "spindle-shanked," that is, thin in the bole and of unusual height—then thinning out must be done, if done at all. Judgment is necessary in thinning so as to leave the trees in the ground which are likely to turn out the most valuable, this rule condemning to the exterminating process all abnormally shaped trees with badly formed boles, &c., &c. The degree of thinning out should be such that, while leaving ample space for each tree to grow, this should be only so that it can develop properly all its parts, but not given in excess, which is too often given. In thinning out, due regard should be had to the varieties of trees, these having been planted at such distances that those of earlier grow between the rows of those of later growth, and to the leaving of a sufficient number of the earlier kinds, or nursing trees, to keep up the necessary degree of shelter to the later kinds, till these get to the period when this will no longer be needed, and the whole space of the ground left for them to fully develop their growth. It is scarcely necessary to say that the pruning of young trees is an operation not less necessitated by their habits of growth than that of thinning. This requires to be done with great judgment, and should only be entrusted to a skilled hand and eye. Many a most valuable tree is spoiled by being badly pruned. The time of pruning trees depends upon circumstances, as the period of the year and the age of the trees. As regards the time of year best for pruning, that at which the sap has ceased to flow--that is, in autumn or spring—is usually chosen; and as to the age of the tree in the case of the hardier varieties—the hard-wood trees—pruning may be done under favourable circumstances in the fourth or fifth year, but much depends upon circumstances.

Time was, and that not so long ago, when tenants not seldom looked upon all plantation schemes of the landlord as a kind of covert way—no pun is here intended—of gaining paying property at the expense of the tenant, although how this opinion could be formed it is difficult to say, save on the supposition that the game nuisance was in some form or other mixed up with the work; and the case was worse where the landlord wished to take up part of old land, either under pasture or the plough, for the purpose of adding to the extent of the timber. Now, however, with the advanced opinions held by them, and the greatly superior education which they now have, tenants view plantations with different ideas, and look upon them as their best friends. This is very marked in the case of farms parts of which are exposed to keen and cutting winds. A recent able and thoroughly experienced authority in this part of estate management states that in a property with which he was connected the tenants most gladly gave several acres of their farm land to be planted, and *continued to pay* the same rent for more than one lease *for the reduced* acreage, so satisfied were they with the advantages derivable from the shelter derived from the trees to their stock and crops—advantages which they estimated themselves, as adding a money increase of no less than one-fifth or twenty per cent. to the value of their farms. This fact speaks volumes for the advantages to be gained from judicious plantation as a source of shelter.

Fences.

We have, under the last section, given a few remarks as to the fences of plantations; we have now to consider the subject as applicable to the farm generally. This, however, we must do very briefly.

Fences are of various kinds, that most commonly employed, the favourite, the finest-looking, and when well planted and looked after the best, as yielding at once protection against inroads of cattle, &c., and shelter and warmth to plants, grass, and stock, is the "quickset hedge" or thorn. For many purposes wire fencing is also largely employed, and is found useful and economical; while for dividing fields temporarily into compartments for the various work of the farm hurdles either of wood or iron are of great service. Other forms of permanent fences are the wooden paling and rails—of which there are various forms—the thorn fence, the turf fence, &c., &c., and, in the pastoral districts chiefly, the dry stone wall or dyke.

Before giving a few remarks on one or two of the most useful of those various forms, we deem it necessary to point out a leading principle or two as regards *their laying* out, or their relation to the fields which *they enclose.* In arable fields, that is, under the *lough, one* part of the fences should be so placed that they will be parallel to the direction in which the furrows run, as illustrated in Fig. 24; the other fences will, of course, be at right angles to these, thus giving the shape to the field we have elsewhere pointed out as the best. In Fig. 24, where *a a* is the line of fence parallel to the furrows, *b b* with its ditch, if any, is at right angles to it; here the furrows *c d* all terminate

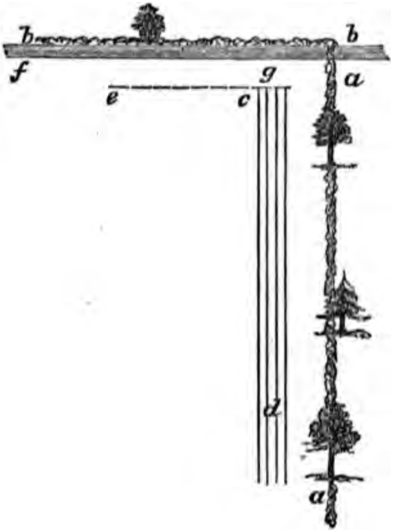


Fig. 24.

at points on the line *e c*, equidistant from the headland *fg*—an arrangement which facilitates the quick and economical working of the field. But if in place of being parallel to the direction in which the furrows run, the fence be placed at a line oblique to them, as the line *a b*, Fig. 25, representing the fence, angular *spaces or surfaces* are formed, making the furrows at *those points*, as *c d*, *e f*, of unequal length, which give rise to great inequalities in the working of the field. This principle shows another point of value in keeping the fields in shape or form square or rectangular, and the disadvantage of having them, even if of the same area, of any other form, as in Figs. 26 and 27, for angular spaces or surfaces with their consequent inequalities in the length of the furrows are not only

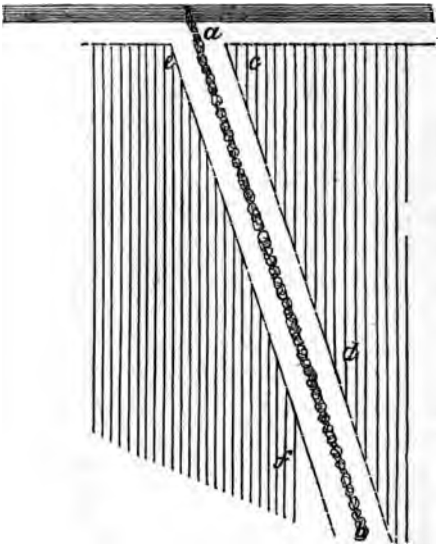


Fig. 25.

introduced, as at *a* in Fig. 26, and at *a* and *b* in Fig. 27, but the field fits, so to say, badly in with fields immediately adjacent, as *c d*, *e f*, Fig. 27, rendering them if arable equally difficult to plough. The point is illustrated in an exaggerated form in Fig. 5, where the fields are so full of those angular surfaces with irregular furrows, that a very unnecessary expense

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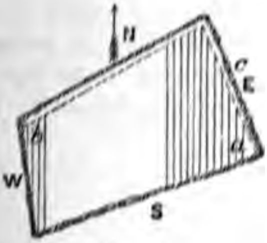

Fig. 26.

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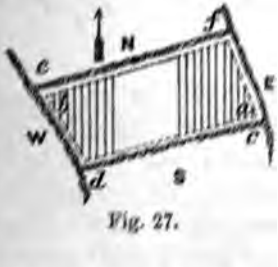

Fig. 27.

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have already noted, it is quite a popular fallacy to suppose that the lower part of a valley is of necessity the most sheltered from cutting winds and sudden blasts. On the contrary, these often, indeed usually, rush down the sides of the sloping surfaces and along the lower line of valley with great force; hence the value, apart from the other circumstances named, of having the fences to run continuous with the line of rivulet in cases such as in Fig. 28. In some cases the bend of the rivulet may be so pronounced or decided that it will be best not to devote the sweep, as *a a*, Fig. 29, to arable culture at all, from the exceeding irregularity in the length of the furrows, but to make that part a small pasture field or meadow, according as circumstances will best dictate. By judiciously laying off the fences of this, and devoting other small fields (see a preceding remark on the value of such in the feeding

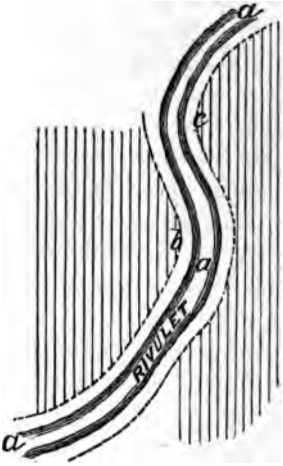


Fig. 28.

of stock), as 1 and 3, in addition to field No. 2, the arable fields such as 4 and 5 may be so arranged that their boundary fences, *b c*, will be placed in proper relation to the furrow lines, *d*.

Roads and their fences also influence the shape of fields and their angular spaces with irregular lengths of furrows. Thus, in Fig. 30, the serpentine road

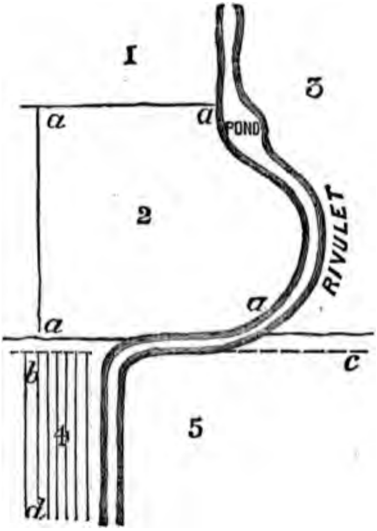


Fig. 29.

between the points *a* and *b* not only increases the distance between those to be traversed, and adds, from the sudden curves, greatly to the fatigue of the horses, but gives most awkward forms or shapes to the fields and their furrows, as in the fields 1 and 2. The road, as a road merely, is improved by throwing it into the diagonal between the points *c* and *d*, equivalent to *a* and *b*; but here again the irregularity in the length of the furrows is observed, as in the fields 3 and 4. This is obviated by the arrangement at *e f*, where the furrows of fields 5 and 6 are in their true position in relation to the fences *g h*, although there is a slight objection in the curves at *i* and *j*, which, however, can be met by making these as easy as possible.

We have said that of all the kinds of fences in use, the most generally employed, and that which affords the best shelter when properly put down and attended to, is the quickset or thorn hedge, as it is called. If properly planted, and carefully attended to for the first few years, a natural fence may thus be obtained, sufficiently strong to resist the efforts of every description of cattle to get through it, and to maintain which but a very small annual sum will be requisite. A bank or

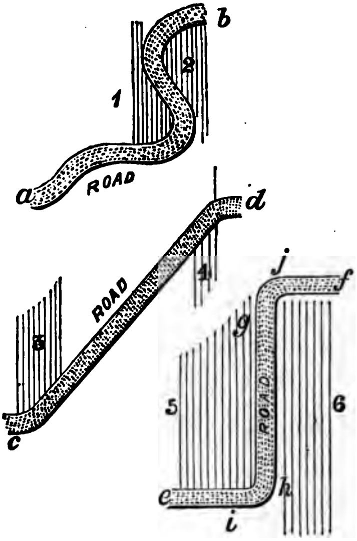


Fig. 30.

mound of earth, at least two feet in depth, should be prepared for the reception of the quicks, which should be three-years' plants which have been transplanted two years. The best description of soil is one of a light sandy nature, which will admit sufficient moisture to nourish the plants, and retain a portion even in dry seasons. Heavy clay soils are not sufficiently pervious to water, and plants placed in such soils are never found to thrive. A mixture of peat or rotten leaves is of great use, and causes the plant to grow with much vigour. The most usual way is, to plant the quicks in a single row, at distances of about four inches apart. But a much better hedge is formed by planting them in a double row, as shown in Fig. 31, with a space of six inches between the two rows, and the plants the same distance apart in each row, and so arranged that the plants in one row are opposite the spaces in the other. By this arrangement, although the plants are really not so crowded, but have more space round their roots from which to derive nourishment, they form a thicker hedge. The proper time for planting quicks is either during the autumn or spring, and in fine seasons the operation may be continued during the whole winter. A temporary fence should be put up to protect the young plants from injury, or from having the shoots eaten off by cattle; and this fence should be kept up until the hedge has attained sufficient strength to require its protection no longer, which, under favourable circumstances, will be in about three or four years

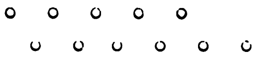


Fig. 31.

after the quicks have been planted. In order that the plants should thrive, they must be very carefully attended to at first, and it is essential that they should be properly cleaned and weeded at least twice every year; and once every year, towards the conclusion of the summer, the hedge should be judiciously trimmed, not to such an extent as to produce stunted plants, but merely cutting off the upper and more straggling shoots, so as to bring it to a level and even surface. By proceeding in this manner, in about three years after planting a neat, strong, and compact hedge of healthy plants will be obtained.

The proper treatment of quickset fences involves many considerations, all of which must be duly attended to if good work is wished for; and these are so numerous that the scope as well as the extent of this work prevents us from glancing at them all, even in the briefest fashion. Careful—and this includes what may seem at first sight paradoxical, rough and ruthless—pruning and cutting in the early stages of the growth of the plants, the first four years, is an absolute essential; and however painful, as painful it is to many to cut away what seem to be most promising shoots and growth, the process must be gone through. We can only give two diagram illustrations of the effects of the two kinds of treatment. One, in Fig. 32, shows the effect of bad treatment, where young so-called "promising and good healthy shoots" have been spared, producing ultimately a fence with no—or, if any, few, straggling, and thin—branches and no leafage at the bottom, where it is most useful, as at *a*, and a multiplicity of straggling branches *leading* nowhere at top, *b*. In fences of this kind, *weeds*, as at *c c*, generally abound, and the wood is *made precisely* where it is not wanted, producing a fence in appearance slovenly in the extreme—the sketch in Fig. 32 is far too flattering—and affording really little true shelter. In Fig. 33 we give a sketch showing on the two sides of a centre line, *a b*, the halves of two shapes or forms of a true, well-trimmed fence, which during the past four or five years has been regularly, systematically, and carefully pruned. A fence thus treated, when it gets to its full growth or true form, which it does, according to circumstances of plant, soil, locality, and climate, in four or five years, has the form of a triangle, as *c b d*, or it may have given to it the curved outlines of *b d e*. Of the two the triangle is the most easily trimmed. In a fence like this the undergrowth is full of thick well-formed branches and proper leafage, affording shelter to the growing crops, whether green, grass, or grain crops, on either side, and has throughout its whole height what might be called the proper adjustment of timbering and leafing to the requirements of each particular increment or advance in height, till the graceful apex at *d* is reached. Where the garden of the farm or the "policy" or "park" grounds abut at once upon the working parts under the plough, &c., the *demands of taste* may be met by having the fences

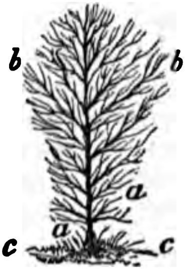


Fig. 32.

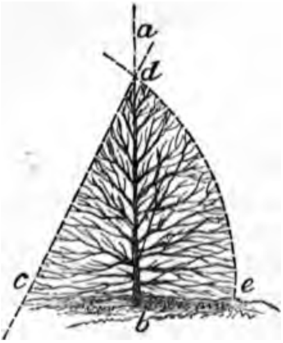


Fig. 33.

trimmed off into a rectangular form, and for this purpose privet gives a rapidly growing and a thick fence.

In setting out hedges on banks great judgment is required, and much could be written on the point. We can only illustrate as before, in the briefest way, the two methods, the bad and good. In Fig. 34, a hedge or quickset fence is often planted on an off-set, *a*, or projecting scarcement, as it is sometimes called. This is a bad method, as it affords not only a most excellent harbourage for weeds, but prevents these from being easily removed, and also the sides of the bank towards the "ditch," or "sunk fence," or "ha-ha," *b b*, being quickly and readily trimmed off and finished. The true position, according to some authorities, is either on the top of the bank, as at *c c*, Fig. 34, or springing out from the side, as at *a a*, Fig. 35. The position in Fig. 34, at *c c*, permits of the method of trimming and finishing a fence shown in Fig. 33 to be adopted; whereas with that in Fig. 35 the trimming has to be done so that one-half of the branches go to and over the top of the bank, as *b b*, the thinner and shorter branches being towards the inner or ditch side, c c. In some

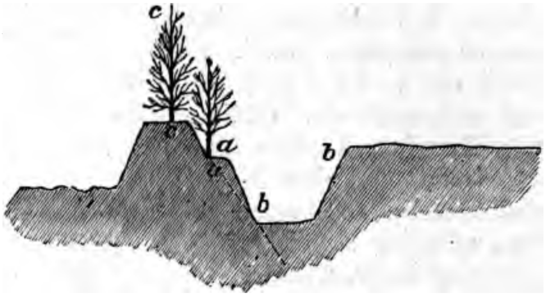


Fig. 34.

cases the ditch may be filled up, and the land added to the field, in the manner shown in Fig. 35, where a drain-tube runs along the bottom of ditch, into which the side or field drains, as *e e*, deliver their water.

Great diversity of opinion now exists on the subject of fencing, some maintaining that all its ends are gained—as in the case of iron or wire fencing or wood railing—where the means of enclosing crops from the inroads of stock &c., are provided, others, on the contrary, holding that fencing proper has a double purpose to serve—namely, enclosure and shelter to be afforded at once to crops and stock. And it need scarcely be said that those who hold the latter view have correct physiological principles, both as regards crops and stock, entirely in their favour. On this point we have, in another part of this volume, already enlarged as widely as the limits of this work admit of, so that we have only to refer to what we have there said, as well as in the other volumes in this series, and to

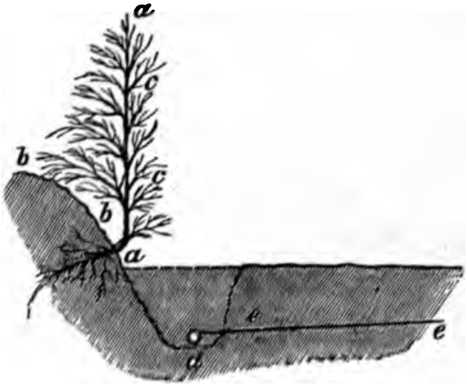


Fig. 35.

observe in conclusion that but very little personal inspection, observation, and experience of fields sheltered and not sheltered by growing fences will suffice to decide the point as to the value of shelter in the minds of unprejudiced persons. If more is needed, it must be gained by a closer study of the habits, alike of plants and animals, and if this be given we have no doubt of the result.

CHAPTER V.

THE GENERAL WORK OF THE FARMS.

UNDER this head, strictly defined, would come the description of the whole routine of farm work, of every class and variety. But this, which would be tantamount to giving here a treatise on farming, is not what the chapter is designed to be the medium of, as it would obviously fail to be of any great practical utility for lack of space to do justice to the details, but would clearly trench upon the province of the volumes in the series which treat specially and fully of these. What the chapter is designed to do is, to afford us an opportunity to glance at the leading features of farm work in the general, as applied to various classes of soils and localities, and which has not been done in the special volumes referred to, as it comes more within the scope of the present volume. Where details are given, they will be on some important leading point which has not already been treated of in the special volumes, or may be supplementary to them where they have been there dealt with.

Drainage.

Of the general work of the farm this is among the most important, and is preliminary to all good cultivation, which, in every class of soil, with few exceptions, could not be secured without it. It is, *of course, not* our intention to go into the details of drainage; that is not essential here, nor does it form part of the scheme of the present volume. We purpose merely to draw attention to the necessity of having all farm lands thoroughly drained. From what has been written and said on the subject, one would suppose that very little of this kind of work remains to be done. But this is entirely erroneous, for not only is there a very large area of land throughout the country which has never been drained in any fashion at all, but of that which is so, or said to be drained, a large proportion is so inefficiently done that it is little better than the land which has not been touched at all by the drainer. It will be the duty, then, of the agent or overseer not to rest satisfied with the mere information that land is drained, but to make such inquiries and such investigations on the land as may be within his reach to see that the work has been properly done. And here it is necessary to point out that the mere constructive details of the drainage may be in good order, and have been done upon a sound system, and yet the drainage be defective, so far as its action upon the soil is concerned, which, of course, is the essential point. This, to which there are few exceptions, if indeed any, in some districts, arises from the drains being cut too shallow, or, in other words, from the drain-tubes not being laid deep enough in the soil. A large proportion of land said to be drained is at least from one-third to one-half, and even more than this, short of the proper depth to which it should have been drained, and from which alone the most beneficial results could be secured. We are too well aware that there are many *practical* men so called, good farmers in many or in *other respects* also, who are opposed to deep drainage, *not so much*, many of them, on the ground that it would not be effectual if carried out, but rather that it cannot be done; in other words, that deep drains, to use the popular phrase, especially in heavy soils, will "not draw." Did space permit, we believe we could prove to the satisfaction of such that they must "draw" or act; they, so to say, cannot help themselves against the operation of a natural law which compels the operation of drainage to go on, however deep the drains may be laid. Nor indeed is it possible to place the limit of depth beyond which they will not draw. In the best or most advanced practice, the extreme limit is just that beyond which no good practical result would be obtained in proportion to the increased expense. But we have just space to say, that those who hold that deep drains will not draw, should consider the fact, which they cannot possibly deny, that in undrained soils, even of the heaviest, most retentive class, water shed on the surface does descend; so that, if water can pass into a soil, it can assuredly pass out of it again if permitted to do so. Now it is just this permission, so to say, which deep drains give. Some, of course, may say, "Well, admit that they can be made to act, what good is there in merely clearing the soil from water lodged deep down?" It is just here that the benefit of deep drainage lies. All admit the great advantages derivable by growing crops from having the soil well and deeply stirred. Now it is in the fact that deep drainage aids this, as good cultivation aids drainage, both being mutual workers in the amelioration of the soil, that its main value lies; not merely as a getter-rid of water *per se*, although even that is a good office to perform, for the presence of water in the soil remaining stagnant there renders the *soil cold and raw*; but that deep drains open up the soil; the descending streams of water passing from the surface through the soil form thin hair-like tubes, so to say, in it, down which the air passes; the water itself also acts as an air-carrier; while the drains themselves, permeating the soil in all directions, act also as air-ducts. This work going on along with that of cultivation, which breaks the upper crust and admits the air to deeper and deeper layers of soil, tends to break it up in course of time, which action is aided, no matter how minutely, still effectively, by the roots of the plants, which descend into the soil in search of the food constituents, which there abound in far greater abundance than in the too often half, and in some, perhaps too many, instances, nearly wholly exhausted, worn-out, upper crust, which has been under cropping for generations. We have thus only glanced at the general cycle of operations going on towards the gradual bringing of the soil into a condition of fine tilth, and that to a great depth, in cases where deep drainage and thorough cultivation of the soil are carried out together, and can only regret that space prevents us from going into details which are as profoundly interesting as they are practically valuable. Enough has, however, been said to show that where the full riches of the soil lying at our service are to be taken advantage of, deep drainage is one of those effective agencies at the command of the farmer by which this can be done. Others will now be but most briefly glanced at, the first of which is

Deep Ploughing of the Soil.

That the lower strata lying immediately below the *upper cultivated* crust or soil abound in manurial mineral constituents, this being more especially marked in the case of the rich heavy clays, we have already pointed out in our remarks on soils. Seeing this, it would therefore appear to be the right thing to so work our soils as to bring these constituents from the line at which they, as a rule, lie wholly or nearly dormant or inoperative, and mix them with the upper soil under cultivation. But correct as this at first sight seems to be, there are circumstances in practice which greatly modify it. The subsoil is often crude and sour, and requires to be under the influence of the air, &c., before it is fitted to be part of the soil which has so long been under cultivation, manuring, and cropping. The approved method therefore points to a stirring and opening up of the subsoil, so as to allow the atmospheric influences to descend to and act upon it, gradually reducing it to a fine tilth, and opening it also up, so that the roots of the plants can descend and take up the mineral constituents present in it. Then, as it gets into proper condition, it may be gradually brought to the surface soil, and thus the general depth of upper or cultivable soil be in time greatly increased. In steam cultivating mechanism splendid implements to work the soil in this way are the "Patent Subsoil Plough" and the "Patent Knifer and Grubber" of Messrs. Fowler of Leeds. In the first-named of the above implements, the grubbing tines and the plough bodies are combined; the tines, preceding the ploughs, descend into and stir and break up the subsoil without bringing it to the surface; while the plough bodies, following and working at a less depth, turn over the surface in the ordinary form of furrow slices. In the "Knifer and Grubber" tines *alone are used*; these work the soil to the extraordinary depth of twenty-four inches. What would the farmers of the old school have said to this?—breaking it and stirring it, but not bringing it to the surface, while the surface itself is left rough and open to the atmospheric influences, grubber fashion. In those two implements alone we believe lies the future of a cultivation which will bring out results far in advance even of the most advanced opinions of the most advanced school of agriculturists. The subject is here only opened up, but enough has been said to show the vast importance of proper means of bringing out the riches which lie in our subsoils, to which we may add, that to those who have not steam power at command, and are not prepared to employ the powerfully efficient implements we have just noticed, there are several horse-worked subsoilers in the market, which do first-rate work at a fairly economical rate. The next points which come up before us are—

Value of the Atmospheric Influences in pulverizing the Soil. Autumn Cultivation and Proper Time for working Soils.

It is impossible to over-estimate the value of the important part which atmospheric influences play in bringing into active operation the riches of the lower, and also in helping the pulverization of the upper, soil. Hitherto, and even now to a large extent—so large that the percentage is altogether on the side of the older method—the getting of the cultivated or cultivable upper stratum of soil into the fine tilth or pulverized state so valuable for crops has been almost wholly looked upon as available by the use *of a succession* of implements, some of them costly in *first price,* and all of them so in their working, and comparatively slow in their mode of operation. The more recent experience, however, of eminent agriculturists, the investigations of scientific men, and the work of our most noted mechanicians, have proved conclusively that the work of bringing our soils into fine tilth may be, and has been, reduced to a minimum so far as machinery or implements are concerned, and that when once thoroughly opened up and stirred deeply, the further pulverization of the soil may be safely and best left to the action of the atmospheric influence. This method of working completely revolutionises the practice of field work, in preparing soils for succeeding crops. One of our leading mechanical firms, who have had the most extensive and varied experience in the cultivation of soils by steam machinery, express their decided opinion as to the great practical value of this new method of working them, and of the enormous power which it places at the command of the farmer in adding so largely to their manurial richness. And it is in the power which steam gives to him, not only in taking at will advantage of the best time to work the land, but also in increasing the depth of the cultivable stratum, so to call it, that the great advantage of steam cultivation lies, to say nothing of the increased breadth which can be gone over in a given time, as compared with that done by horse power. We have here alluded to two important points, one of which, at all events, should never be lost sight of, and that is, the working of the land at the proper time. It saves no time, in the true sense of the term, and it does no good, rather contrariwise, does much harm to the soil, to send in the implements to work it when it has been subjected to heavy or long-continued rains. *In truth, it is* difficult to over-estimate the losses which have been sustained by working soils under such circumstances, more especially where these are of a heavy character, and where horse power is used to work the implements. Steam-wrought implements can be put sooner on to land which has been rain-soaked than those worked by horses, as there is no poaching of the surface by the horses' feet; but still, even with the steam-wrought implements, caution should be exercised, as the freer the soil from wet the better.

The value of the system of autumn cultivation lies chiefly in the way in which it aids the pulverization of the soil above described, and this by turning it over as early as possible in autumn after the crops are taken from the land, and leaving it either in a rough state, as the grubber—perhaps the best implement for working the soil under such circumstances—leaves it, or in deep ridges, precisely the same as those in turnip or potato culture. Left thus exposed during the winter to the frosts and various atmospheric influences, it is so acted upon that its particles become loosened, and when worked in spring, in fitting weather, it falls into a fine tilth; and often but little more is to be done in preparing the land for the green crop which is to be taken off it than merely giving a turn or two of the harrow and then forming the ridges for the crop, or drilling in the seed, if it is to be grown "on the flat," the system best adapted for dry soils and climates, as the ridge sowing is for those of an opposite character. The advantages of autumn cultivation are gradually becoming more widely known, and wherever the system is practised these are so apparent that it is rarely if ever abandoned. As tending *greatly to* promote the extension of the system, the *value of steam* cultivation is very great.

Rotations, or the Alternate Husbandry System.

There has been in the whole history of the art of agriculture no feature so remarkable as the change brought about in its practice by the introduction of the system of "alternate husbandry," founded upon what is called the "theory of rotation of crops." The scientific points connected with the subject will be found in the appropriate volume of "Outlines of Modern Farming;" but it may be simply stated here that it proceeds upon the assumption—though there is another theory of the system, the point being yet unsettled—that as one crop draws from the soil only a certain constituent or class of constituents, and another crop draws another sort, it follows, that if the same crop was always grown on the same land that land would in time be deprived of that class of constituents; and further, that by changing the crop, substituting one which draws another class of constituents from the soil—that which the preceding crop has left in it—and by so arranging a cycle of different crops, each drawing its own set of constituents from the soil, and by supplying manure to make up for the parts withdrawn, the soil is maintained in a perpetual state of fertility. Previous to the introduction of this system, which was greatly aided by the growing of a set of crops known as "green crops," at one time unknown to British agriculture, the land became in time exhausted and refused to grow the crops put upon it, for which the only remedy was to allow the land to rest from cropping for a time or to be worked as "fallow," that is, ploughed, weeded, and cleaned, and left without a crop till the next season. This fallow *system obviously* was a loss to the nation, as now, since *the alternate* system is introduced and green crops extensively cultivated, all soils are cropped continuously under changes of crops, none being allowed to lie fallow save the clay lands, and of those in many cases only the heaviest and most retentive. By the cropping of the land with green crops in place of adopting the "bare," "naked," or "summer" fallow (for by all these names it is designated), green are often termed fallow crops.

Since the introduction of the alternate system, where leases are granted, it is very generally the custom to insert therein clauses binding down the tenant to crop his land according to certain stated rotations. The pecuniary policy of this is very questionable, for apart altogether from the fact that a farmer, if a good one, and a thoroughly honest and conscientious man—and it is the agent's duty to see that, so far as possible, he should select men of this class to form the tenantry of the estate—will be sure, for his own interest, to crop and cultivate his land in the way best calculated to yield the highest produce, and this he is the most competent man to find out. There can be but little doubt that each variety of soil, and this, moreover, largely influenced by locality and climate, has its own peculiarities, demanding its own system of rotation. So varying and varied are the results of systems of cropping and of the action of manures, &c., that it is not possible, from a scientific no less than from a practical point of view, to say definitely that any one system is the best. Agriculture is not a fixed science, to be governed in its practice by any set of hard and fast rules; we, therefore, in its *true* and best interests, hope that, before long, the *system of* restricting farmers to certain rotations, &c., *will soon* give way to a more common-sense, because more truly scientific, system. One consideration alone ought to make one pause before fixing on a definite plan of cropping to be followed under all circumstances, and this is, that it is well known that many lands refuse to grow certain crops, which at one time they yielded in abundance—getting "sick," as the term is, such as "clover sick," "turnip sick." Now it does seem very hard, especially where the rotation is a short one, to compel the farmer to put his land under a crop which will not only not pay him, but will also tend still further to aggravate the evil by increasing the soil's tendency to "sickness."

* *

Farmyard Manure and Compost Heaps.

The reader interested in the subject of manures will find them treated of in the second volume of "Outlines of Modern Farming" in this series. What we have here to concern ourselves with is merely a general glance at the treatment and storing up of farmyard manure or dung, and how this can be supplemented usefully and economically by compost heaps. As regards the general or popular method of treating farmyard dung, it may be characterized as the very worst which can be adopted. On referring to the work above noted, it will be seen that by the usual method of heaping up the dung in the open air a large amount of its fertilizing constituents is lost by evaporating into the air, sinking into soft and porous soil—on which the heap is too often placed—or being washed out by the rains, and finally, by allowing the liquid portion to drain away, if the heap be on solid ground, to the nearest ditch or stream. It is not easy to estimate the amount of loss sustained by this careless way of treating dung, but science and correct practice alike tell us that it *must* be large. The true method is to have a properly walled-in dung-stance or enclosure, with impervious floor and sides, and provided with a tank at one point into which the drainings from the dung pass, and into which also all the liquid manure from the cow-house, stables, &c., refuse water from the farmhouse, &c., should be led by a proper series of drains. The dung-stance or pit should be covered over with a roof, supported by timbers placed at intervals, so that the sides and walls are perfectly open. Dung kept in this stance, and properly turned over and watered with liquid manure at certain times, is worth a great deal more than dung kept in the bad way just described, being not only richer in manurial constituents but more easily applied to the soil.

While there are now numerous artificial manures at the command of the farmer, he should ever look to the solid dung of his live stock as the mainstay of his cropping system. The artificial manures above noticed, when first introduced, carried with them, through the hasty generalizations of some, the most extravagant notions as to their utility, and were lauded accordingly, as making the farmer independent of the farmyard manure or dung. But the sober facts of experience, no less than the maturer thoughts of scientists, soon showed the fallacy of this, and that they were only useful as supplementary aids to the other manure. But while the farmer must, or ought, to look to dung as his best manure, available for all crops and applicable nearly under all circumstances, there is another source of solid manure—which, like the dung of live stock, performs *a mechanical* as well as a chemical part in its action on *soils—too frequently* lost sight of, and but too seldom *availed of*; we refer to the matter of compost heaps.

Labour being such a costly matter nowadays in connection with farm work, the formation of "compost heaps" on the farm must be arranged with a view to economize this as much as possible. The labour or work involved is of two kinds; first, the collection of the materials to form the heaps, and, secondly, the distribution of its contents to the field or fields on which they are to be used. It will be a fortunate conjunction of circumstances which admits of these two points being followed closely out together; but not seldom will it happen that the materials may be the most easily collected at a locality furthest from where they will have ultimately to be used. In such a case a compromise may have to be made, placing the locality of the heap midway between the two points; but the best plan will likely be to have it as near the fields where the manure has to be used as possible, as it is often of the utmost importance to have the manure carted on to the field at the most favourable opportunity.

As in garden compost heaps, so in those designed for manure-making for the farm, every substance that can decay should be collected for their formation. If plantations are on or near the farm, and in the latter case leave obtained for their collection, all the leaves which can be scraped together should be obtained; those also from the roadsides. Fern leaves or bracken branches, although not so rich in fertilizing substances as the leaves of trees, will help to form the basis of the heap. These fern and other leaves form no bad bedding for the stock, and their value for the compost heaps will be added to if thus previously used.

Peat, as in garden composts, comes in also well to *form the basis* of the farm compost heaps. It is, however, *worthy* of special note here, that peat and bog are by no means always the same substances, although almost universally considered to be so, and it is sometimes very difficult to define the difference between the two. Good peat is composed of a mixture of decayed vegetable matter, fine sand, and loam; the subsoil is sandy gravel, and not the swampy, water-logged places which are popularly supposed to be the localities *par excellence* for it. It is there, however, that boggy soil is found, and it is usually little better than so much mud. This would not matter if the mud was good, for good mud is by no means a bad thing for compost heaps; but being of a very peculiar nature it cannot be ameliorated or mended, so to say, at least to the same extent as peat soil. This also, although essentially of a fertilizing character, is so mixed with an acrid acid that it must be treated with lime before being put in the heap, with farmyard dung in the proportion of two parts to seven or eight of the peat soil, one to one and a half of unslaked lime, and salt at such a rate that three to four hundredweight of it will be given to each acre of the land to which the compost is applied. The mixture will be found excellently adapted to form the compost heap basis. Farm compost heaps are not so frequently turned over as garden ones, the bulk of material being too great to admit of the costly labour. Some, indeed, hold that frequent turning is not good, as it weakens the manure; but this is a disputed point. When fermentation ceases too soon, it may be renewed in the heap by boring holes with a stout pole at intervals, those reaching, if possible, to the bottom, and pouring in liquid manure or the drainings of the heap itself.

Lime, and its Management, as a Manure in improving Land.

Of the various substances or materials at the command of the farmer or gardener, or of both, by which they can add to the fertility of their land, and thus help on the progress of the crops which it bears, although the good results may not always be realised, there being "many a slip between the cup and the lip," lime is one which plays a most important part. There are few soils which are not greatly improved by its application, and this in a double way often, for in some it acts beneficially in a mechanical as well as in a chemical way. A good deal—we should say, a great deal—depends upon the way in which it is applied; and in many instances the application is made in such a gross ignorance of its properties and its method of action, that tons of it are annually thrown away. Thus, lime is often carted away from the lime-kiln to the farm, thrown down on some spot considered handy or convenient, but often not at all so, and there allowed to lie "till it is wanted," as the phrase goes, exposed to all weathers and all the influences of the atmosphere. Treated thus, it will too often be found that it is wanting in what constitutes its true value. Lime, in its natural or unquarried condition, is what is called in popular language simply a "stone," and in this condition it is worthless manurially, and indeed obviously, from its mechanical condition, it could not be used. The first operation through which it goes to fit it for use as an application to the land is to calcine or burn it in furnaces or kilns; the heat drives off the water and carbonic acid gas, and leaves the previously hard stone in a soft condition, known as "lime-shell." In this state it is no longer difficult to be affected by the weather and by atmospheric influences, but, on the contrary, peculiarly liable to be so affected; so that, if exposed to damp and rain, it crumbles away, and forms a bluish-coloured, solid mass, or becomes changed into a white powdery state. In this form it is now termed a "hydrate of lime," having absorbed a certain percentage of water and of oxygen from the air. If allowed to lie longer exposed to the weather after getting into that condition, or if more liquid—as rain—be added to it, then it becomes a fluid, pasty mass, the tendency of which is to harden ultimately into lumps or masses of mortar. It is when in the powdery condition, or when it is properly "slaked," that it is fit to be used as a manure; not as in the latter condition above named.

The method of "slaking" it, or reducing it to a fine powdery state, depends upon the way in which it is to be used as a manure. In applying it to the land on the large scale the lime-shell is carted along say the drills, and deposited in heaps. The quantity in each and the number of each on a given surface will depend upon the dressing or application per acre. Twenty bushels per acre will require, for example, the heaps to be deposited in squares, the length of the side of which will be about thirty-three feet; or a convenient rule will be, making nine inches on the side of each square, or thereabouts, to be allowed for each bushel per acre applied. Each heap of shells must then be covered with soil, and left for a few days. The operation of "slaking"—done quickly by the mason or the bricklayer in preparing his lime for mortar making—is *then begun* and carried on *slowly by a natural process;*

the damp of the soil and that from the atmosphere penetrating it, and perhaps rain falling and penetrating through the soil covering, serving in the same way as the water in the quicker process named above. The farmer or his foreman should narrowly watch the process as it goes on, and it will soon be seen operating upon the soil which covers the heap of "shells," bursting through this and opening it up, and showing the lime in white patches more or less large. The period when the lime is ripe or thoroughly slaked may be known by probing it with a pointed stick, or better, by partly uncovering it with a spade. If the stick passes easily down to the bottom of the heap, the lime is slaked; but this will be more easily seen and ascertained by the opening up with the spade. If the lime is reduced to a powder, the soil which covers it should be well mixed with it, and again made into a heap. This is allowed to rest for a few days, more or less, according to the weather, and then it is in a fit state to be applied or spread over the land. This spreading should be carefully done, so that the produce of each heap is given to its own surface of land, so to say. In preparing compost heaps either for the farm or garden land, the lime may be more quickly slaked by pouring water on it, and as soon as slaked, which will be very quickly done, mixed with the soil. This is placed in layers alternating with the vegetable and other manurial matters, which go to make up the heap. To conclude, never allow the lime by exposure to go beyond the proper degree of slaking as above described, and to form itself into a pasty fluid. This will in time "set" again or harden, and is of no value, or but of small value, as a manurial application to land.

Mixing of Soils.

A word or two on this point may suggestively conclude these paragraphs, before taking up the cultural management of different kinds of land. The best known, and in consequence the most largely practised, method under this head, is the mixing of burnt clay nodules with heavy clay soil. This can scarcely be said to be the mixing of one soil with another, as the basis of both is the same; but the conditions are so different that they may be said to be different substances. The chief advantage to be gained by this system is a mechanical one; the hard nodules of the burnt clay opening up interstices between the particles of heavy, close, and retentive clay, so as to allow the atmospheric influences a comparatively free admission, which in time act, as we have already shown, as the best pulverizers of heavy, or indeed of any class of soil, requiring to be brought into that fine state known technically as "tilth." The clay is burnt in heaps by the aid of coal, the fuel and clay being placed in alternate thin layers; and fire being set to the lowest, which is fuel, the heap gradually gets into a glowing mass, which reduces the clay to small hard nodules, which are then ploughed into the heavy clay-land. Another method open to adoption for opening up and altering the condition of soils of this class, is by mixing sandy soil or sand of good quality with them, just as, in the converse way, sandy soils are improved by mixing them with clayey soil, or, as is most generally done, with marl. Peaty soils and bog earth are treated again with lime in the first instance, which kills the "sour," acrid qualities, and fits them for bearing crops, the first generally taken being oats, followed by potatoes. Soils of this kind are capable of great and rapid improvement by mixing them with soils of a superior quality. That in process of time we shall see this system of mixing soils largely adopted, we have little doubt; nor do we the less hesitate to believe that its importance will be so esteemed that a systematic plan of working, such as that adopted by "navvies" in the formation of railways, &c., &c., will be organised, so as to bring to the aid of the farmer all the advantages of economy in time and cost which mechanical appliances systematically worked are calculated to secure.

This system of admixture of soils was, perhaps, more extensively carried out by the farmers of days long since gone by than it is now; and the enormous tracts of land which have been reclaimed and utilised in the sandy districts of Norfolk, the fens of Cambridgeshire, the heaths, commons, and wolds of Lincolnshire, the clays of Sussex, the sea-margin and tidal-river lands of Essex, the dry and chalky hill-slopes of Wiltshire, and the poor and hilly lands of Devon, attest the patient toil and indomitable energy of these men, who had none of the aids and appliances of modern farming to assist them in carrying on their work. By marling and chalking the sandy soils, heathy lands, and wolds, by draining the clays, and by claying and liming the peaty and boggy lands, wonderful success has been attained; and it is matter of surprise, seeing the large tracts of such lands as we have named still to be utilised, that some similar efforts have not been made in our own times.

Having thus gone into, in very brief, but we trust practically suggestive, fashion, the consideration of *subjects of special* interest and value in connection with the cultural work of the farms of the estate, it now remains for us to glance in like style at the management of different kinds of farm lands, and the methods of bringing reclaimed, poor, or worn-out soils under cultivation. Of the various kinds of farms we have already, in Chapter III., given a description, as also of the best methods of laying them out into fields, &c. The extent no less than the scope of the present volume limits of necessity our remarks to a few only, and these the kinds or varieties of cultural management the least known and practised. This will be more interesting and practically valuable than taking up space by considering those kinds of farming which are very extensively adopted, and therefore well known, and which, moreover, are to a large extent described in detail, if not in the general, in the other and special volumes in this series taking up "modern farming."

Mixed Husbandry Soils.

We have alluded to the fact that where the rotation on mixed soils, in which green crops as well as cereals and beans are grown, is very limited, thus bringing the same crops on the same land with too short an interval between them, the soil is apt to get "sick," and will grow crops which every rotation may become poorer and poorer. At one period the clover was the only plant which thus affected the soil, but of late years in many districts there are other crops affected; for example, on some farms there is the greatest difficulty to raise turnips in weight enough to feed the cattle in winter—a greater one to get over than *the failure* even of the clover for summer feeding or for *hay.* *But* the cereals are also beginning to be affected, this being specially true of the barley. The only remedies for this state of matters are, high farming for the wheat and oats—that is, the finest cultivation, and the most liberal yet judicious use of manures—and a change in the rotation, so as to extend the interval between the taking of turnips or other root crops. One extension proposed is turnips or mangold, next wheat, then barley, with the seeds, as clover, trefoil, rye-grass; the grass from these to be either grazed or mown for one year when wheat follows, thus making the four-course into a five. But the six-course is, perhaps, the best of all; and it certainly is worthy of remark that years ago, in certain districts where it was invariably followed, the crops of all kinds were better in quality and larger in yield than now. The six-course may be as follows: turnips, barley, followed by seeds, the grass of which is kept down for two years, then wheat, and last barley. The grass should be made into hay, or cut for green food for soiling the first year, and grazed by sheep or young stock and horses the second year. This mixing of the live stock, or having the land grazed by different animals, is stated to have an exceedingly good effect upon the sheep, preventing the land from being over-manured by them. This application of the six-course system to suitable soils is very likely to get over the difficulty of the turnip-sick land, while at the same time the yield of the cereal crops is rather increased than diminished, and much labour in horse-work is saved by having one portion of the farm under grass for two years. Change in the green crops or root crops grown no doubt would be advantageous; thus, when turnips would be due in the course of the rotation, in place of taking a second crop of this from the same land, take mangold-wurtzel; next change in the rotation to be potatoes, the next seeds, and the next green forage plants—as vetches, rye, or rape—and last coming round again to the turnips. So also with the cereals; thus, if wheat is the regular crop due in the rotation, take barley, next oats, then, last, wheat as before. There would be thus a double rotation going on, and effecting a very marked diversity in the character of the plants put into the soil. These changes in rotations are being now advocated, and shown indeed to be essential, owing to natural circumstances hitherto much overlooked. Nor is it altogether a mere fancy, as suggested by the late Professor Anderson, the well-known agricultural chemist, that it might very likely, as he deemed it would, be a good thing to change the manures used, thus introducing what might be called a "rotation of manures"—a principle which we have very good reason to believe will some day be part of the practical farming of the country.

Turning now to the *Grass Lands*, the importance of keeping them up to the highest mark of production need not be here dilated upon. The demand there is, and which is apparently ever on the increase, for stock and for dairy produce, ought to make it worthy of the farmer's best attention. Far too little attention is paid to the quality of the herbage in pasture and meadow land. They may in truth be said to be classed with grasses which are not grasses; the paradox being true, inasmuch as they are generally coarse and innutritious, so that to begin to apply vigorous application of manure with such stuff to work upon is reversing the process which should be gone through. The first work to be gone into is, then, the renovation of the grasses. Unless the case be very bad, necessitating nothing less than ploughing up, cropping, and therefore laying down the land again with good seeds, much benefit may be obtained by well scarifying the surface with a light scarifier, and then sowing a mixture of good seeds, taking care that these be suitable for the soil.

The manuring of grass lands is too often done without duly considering the circumstances under which only it can produce the best results. On this point much could be said, but we can only here refer to the volume in this series which treats of general farm cropping, in which some hints of value will be found. We can only find space to give one, namely, that as seeds ought to be suitable to the different classes or kinds of soil in which they are sown, so ought manures, and not merely their constituents, but the period at which, and the way in which, they are applied to the land.

Pasture against Cereal or Corn-growing Land.

A great deal has been written and said of late years as to the doing away with large areas of land which have been under cereals, or rather alternate husbandry, and laying them down to permanent pasture. In view of the demand for live stock already noticed, there are many temptations for the landowner to consent to this; but caution should be exercised in this matter before deciding in favour of the plan; every point should be well considered—the suitability of the soil, the climate, locality, the kind of stock to be kept, or whether the produce is to be used by dairy cows, &c. While many advocate the system, there are numbers of high practical authorities who are decidedly against it, believing as they do that there is too much pasture land already in the country. Certainly it seems the safest plan to *have a fair adjustment* or a nice balance between the soils devoted to different crops, as in a well-managed mixed husbandry farm—perhaps, if not wholly so, the most successful of all farming—rather than giving undue preponderance to one class of cropping or cultivation. Before concluding our remarks on grass land management, or rather some points only of it, we may refer to the wide field there is for the improvement of poor pasture lands, especially in upland districts, or where there is hilly or uneven ground, by a simple mode of irrigation. This is merely a modification of the system of sheep-farm hill-side draining, the drains being cut by means of a plough and across the face of the hill or sloping land. These act as the carriers; and by simple "stops" of pieces of turf placed at certain points, the water is shed over the surface in the way described in the section on irrigation. Wherever this plan has been adopted the grasses have been materially improved; and by the top-dressing of the land with artificial manures—of which, by the way, common salt, at the rate of two to four cwt. per acre, is a good one—the advantages are still more decided. There are many farms on which a fair supply of water is to be had, to which this system could be applied with economical results.

Clay Soils.

If there be one class of soil more dreaded by farmers than another to take in hand, it is that of the close heavy clays. But although there be in its farming enough to vex the soul of the oft-bewildered husbandman—to use a graphic, if rough, Lancashire expression—"above a bit," still it must not be forgotten that this class of soil is the richest in fertility we have, and, what is a very telling point in the argument, constitutes by far the largest average of soils in the kingdom. To farm, then, such soils becomes a matter of the highest national importance, and it is just possible that our management of them hitherto has not been conducted on the best and most scientific principles. Hence, perhaps, so many, at least a few, of the difficulties we deplore in connection with them. That in the application of the power of steam lies one of the means by which these difficulties will be overcome, we think there can be little doubt. That this, in conjunction with a stricter attention to draining, autumnal cultivation—a vast power in itself—the application of the proper kind of manures, and their mechanical as well as their chemical treatment, will make clay-land farming much less the dread of farmers than it is now, we have also as little doubt of. That we have a vast deal to learn in connection with their management is another point, perhaps even less open to doubt, although some may not believe this, or only in a modified sense.

The very first step to be taken, without which all other methods of working will be but as lost time, in the treatment of clay lands, is their thorough drainage. The drains must be deep, the distance between them determined by the closeness and retentiveness of the soil. Shallow draining on such soils is but money thrown away. It is quite a mistake to suppose that drains will not "draw off the water," as the phrase is, if in such soils they are deep. We should have no hesitation in making drains 4 feet 6 inches, nay, even 5 feet, with the perfect assurance that, if properly laid, they would act thoroughly well. The more retentive the clay the closer also must the drains be to one another. The drier the weather in which drainage work is done *the better*; the falling in of the sides in such soils not being so likely to happen as in lighter and freer soils. The drainage being thoroughly done—and not in any way "scamped," one of the greatest dangers to which drainage, in common with all work which is afterwards concealed, is liable to—the next point is the cultivation of the soil. Now it so happens that the greater the fertility of the clay soils, the more retentive and close in texture they are. There are a few exceptions to this, and it is in loosening this texture that true cultivation consists. The air having access to the particles of the soil, brings them within those atmospheric influences than which none are more powerful in bringing into play its latent richness, so to speak.

Now the air itself, while thus performing these beneficial influences, is at the same time the best and the quickest pulverizer. Nothing can equal it in opening up the texture we have referred to, if only we can get it to act. The difficulty in these close retentive soils is to do this. Drainage greatly helps this, but it is only a means to an end, or one only of the influences we require to set to work. Ploughing, and deep, thorough ploughing, is the main agency; but with the usual implements, and the limited depth to which the fullest horse-power we can set to work can give us, we have little chance of doing much with it. But there is ploughing and ploughing, to paraphrase the French phrase, and only the best action on the soil can be obtained by the best system of ploughing. And on this point we have to remark, that the one great essential in good ploughing is, to work the land only while it is in proper condition for working, that is, when it is *not wet or* under the influence of long-continued rains. *Elsewhere* we have again and again insisted upon this, *and have shown* that a large proportion of the loss we undoubtedly sustain from deficiency in the productive powers of our soils arises from the fact that so many will plough soil when it is wholly unfit to be ploughed. This no doubt arises from a desire to save time, but there is such a thing as being unwisely hasty in our work; and here there is no doubt we are so, and to a much greater extent than farmers are disposed to admit. Better far to wait till the land is in good condition to be ploughed.

And one great way to gain this is to adopt the system of autumn cultivation. The weather, taking the years all round, is generally good, and upon the whole dry, immediately after the crops are harvested, and not a minute should be lost in turning over the land as soon as the crops are off it. A double advantage is thus obtained: we get the soil in the best state for ploughing, and, that being done in an early part of the season, we have the longest possible period for the air to act upon the soil, and, as we have said, that is the best pulverizer, in conjunction with the frosts of winter, we have.

But how to work the soil so as to pulverize it deeply?—that is the point in the working of retentive clays. Here we now have the power of steam to come to our help. By the vastly increased power which the steam cultivating mechanicians have imparted to their apparatus, they can go to a depth which, even but a few years ago, would have been believed impossible. And by their apparatus the soil is not merely turned over in slices—that is not what is altogether wanted; it is broken up and pulverized; and better still, by a new and thoroughly successful method of working, by the aid of appliances as ingenious as *they are efficient*, while the subsoil is stirred, and thoroughly stirred, it is not at the same time brought to the surface, but put into that condition in which it is best fitted to receive the ameliorating action of the atmosphere, while at the same time we have the surface left in the best condition to form a seed-bed. As before said, it is to steam that we look to give us the means to bring our clay soils into proper condition and to lay open their riches, and steam, under the skilled guidance of our agricultural engineers, is rapidly doing what we want of her.

One of the peculiarities of clay-land working is the summer fallowing, which at one time formed an essential part of all clay-land farm operations, but which has been greatly modified, and in many instances done away with, by the introduction of the root cultivation, or "green-cropping," as it is commonly called. Summer was also called, "bare" or "naked" fallowing, from the circumstance that the land was left for a season wholly devoid or bare of crops. This was done with the notion then prevalent that rest from cropping was the only way to bring back to the soil those elements of fertility which previous crops had removed from it. Now, however, this idea is exploded, and when resorted to it is chiefly for the purpose of having the opportunity of thoroughly working the land, not only to pulverize it, but to get rid of the enormous crops of weeds and weed-seeds with which some clay soils are infested, and perhaps specially of that terrible pest the "twitch" or "couch" grass. But by the introduction of root crops the necessity for bare fallowing is greatly done away with, inasmuch as *the mode* in which they are cultivated admits of the *soil being* worked, stirred, and cleaned from weeds *during the* period of their growth, so that while a crop is being got off the land, all, or nearly all, of the advantages of bare fallowing are being also obtained.

The sequence, then, of operations in the working of clay lands would seem to be somewhat as follows. Deep, thorough drainage; ditto ploughing, but ploughing only when the land was in fit condition to be worked; early or autumn ploughing or grubbing, if bare fallows are dispensed with in the cultivation of root crops, so as to ensure the clearing of the land from weeds as much as possible; the effective thorough working of the soil between the drills and the plants in the drills; and, finally, the removal of the root crops—when these form part of the rotation—when the land is as dry as possible, to prevent all unnecessary poaching of it by the horses' feet—an evil little less damaging to the soil than its ploughing in a similar state, and rendered all the more so from the fact that it is followed almost immediately by the ploughing of the season.

The following is Mr. Mechi's rotation for and management of his heavy lands. "First year: Red clover after oats once mowed for hay; afterwards top manured with 10 loads of shed manure; then close folded with sheep, eating cake, corn, malt combs, and bran. 2nd. White wheat, 9 inches apart; 4 pecks of seed per acre; horse-hoed twice, and well hand-hoed in spring. 3rd. Rivett wheat; same quantity of seed as white wheat, but manured with 2 cwt. of Peruvian guano, and 1 cwt. of salt. 4th. Mangold; land broadshared after harvest; weeds, &c., harrowed and burned. Twenty-five loads of shed manure spread in October or November. Land trench-ploughed; two horses in front plough, followed in the same track by iron plough (breast taken off), drawn by four strong horses. Land lies until early in April, then broadshared; 3 cwt. of Peruvian guano, and

2 cwt. of salt worked in, and mangold seed drilled in rows at 28 inches from row to row. Time of drilling, April 15 to 20. Seed previously soaked in the wet sand for a few days. 5th. Wheat. Sow in November, with 2 cwt. of guano and 1 cwt. of salt. Land scarified after harvest; weeds and stubble collected and burned. 6th. Beans. Twelve loads of shed manure carted and spread, and land ploughed very deeply, with three horses abreast; drilled at 18-inch intervals. The pressure put on to the drill, so that the coulters should cut through the furrow slice, and deposit the beans deeply in the subsoil. 7th. Wheat, either white or red, drilled in October or November, with 1 cwt. of guano, and 1 cwt. of salt, the bean stubble having been cleaned, cross-ploughed, and then ploughed in to form ready for the wheat. 8th. Winter tares. Wheat stubble scarified and cleaned, and 2 bushels of tares drilled per acre. No manure applied. Tares cut in May and June, passed through the chaff-cutter, and given to horses and cattle; rest made into hay. 8A. Cattle cabbage same year after tares. Land heavily manured with twenty-five loads of shed manure, then deeply ploughed and trench-ploughed, same as for mangold. Cabbages planted out at intervals of 28 inches, the lines being drawn by the drill. Cabbages consumed in early spring by ewes and lambs, and some pulped for the cattle. All, however, taken off the land. We generally have two or three acres of cabbages planted in March, and consumed in September and October. 9th. Oats; 2 bushels per acre, drilled at 6-inch intervals, sown down with red clover. Manure: 2 cwt. of guano and 1 cwt. salt. The beans and wheat, mangold and cabbage, and all horse-hoed with Garrett's patent horse-hoe, two or three *times, and also* hand-hoed. The knives are changed

according to the width of drill. A man and pair of horses do 12 acres per day."

Reclamation and Cultivation of Waste and Improvement of Poor Lands.

The methods to be adopted in reclamation of land, and the expenses of doing it, depend upon many circumstances—the climate, locality, character of surface, soil, and subsoil, and, as connected with the locality, the facilities for carrying on the improvements. Thus on some lands the surface, such as in rocky heaths, may be covered with stones and boulders; but if the circumstances of locality and climate be such that it be deemed the best plan to divide the reclaimed land into parts by fences, the stones, in place of being an incumbrance, will be an advantage, as they will be available for the purpose of forming the fences, in the case of the larger ones, and in those of the smaller for the drain filling, for in such circumstances it will be the more economical way to use the now rather old-fashioned, but, where well executed, still fairly good, plan of stone-filled drains, seeing the materials are so close at hand. If the boulders are very large, and lie anything at all "in line" of the proposed fences, in place of blasting them all up some of them, at least, may be made to form *in situ* part of the fences; indeed, for the matter of that, the line of fences in some instances may be so arranged as to make the boulders fall in to be useful as they lie. Two may be often found in such relative positions that they may form excellent gate bolting parts. We throw out these remarks as they may serve as hints to show how by looking at all points of a subject a good deal of economy may be effected. When the large boulders lie within the enclosed parts of the land to be used as pasture lands, some of the very largest, the expense of blasting which would be somewhat great, might even be left as they are; they would form pleasant shelter spots against biting winds and cutting rains or hailstorms for the stock, which would be only too glad to get this shelter. In rough outlying land such large boulders or rocks—for such they are—would be no disfigurement to the land.

The stones and boulders met with in such lands, by treatment of a judicious kind, will thus add little or nothing to their cost of reclamation, save the cost of labour in removing and using them for fence and drain work; as materials they will cost nothing, for they are there ready to hand.

Again, in the case of reclaiming land along the margin of rivers in which embankments have to be made, it may be found that the cost of raising these in some instances may be very materially reduced by having—as in the last instance—the materials at hand. Thus it may often be found that high mounds or knolls may be placed close to the intended site of embankment, which, being in themselves detrimental to the character of the land which is to be enclosed, by being removed will afford a supply of material useful in raising the embankments, and which, if it had to be brought from a distance, as it often has to be done, would add materially to the cost of the work. These points are here alluded to, not so much as examples of the way in which the special works are actually to be done, but rather as affording hints how, by a judicious looking at the general work of reclamation to be undertaken in each special case, much economy can be effected by also looking after the special details. As we have in another place in this work remarked, the actual ability of the manager is, perhaps, more shown by the way in which he avails himself of what to him are facilities, but what to others would be things quite overlooked, or, if seen, neglected or condemned as quite useless.

The same remark applies to the reclaiming of land from the sea, and here, perhaps, with more force than in the cases named above, as in a large number of instances materials lie, so to say, ready to hand to be availed of, if only looked out for, and the best way of using them be considered. For there are always two ways of using the very same materials; one engineer, for example, will not only get twice the amount of work done from the same material at a greatly reduced cost, but will do it in half the time in which another will. In sea-walling and in its attendant work, as the formation of the delph, some will do a very much longer extent of work than others will, simply from the clever way they avail themselves of the materials at hand.

In reclaiming heathy and stony land, the drainage of course is a necessary part of all such work. In place of making the drains wholly of stones—that is, stone filled—if available, tubes or tiles may be used as the water-ducts, the upper part only being filled in with stones, but if tubes or tiles are expensive in the locality, stones may be wholly used.

What appear to be the most hopeless of all "lands," if, indeed, the term can be applied to them in their first stages, for the purpose of reclamation, are the pure sands; and yet, even out of such apparently useless tracts, it is amazing what science, skill, and labour can obtain in the way of useful crops. One *advantage* such soils, if some of them can be so called possess, is that of warmth. This is a source of strength, so to say, in dealing with them, as it enables the after processes of reclamation and cultivation to have a good chance of success, warmth in the soil being a point to be aimed at, and is, indeed, one of the advantages obtainable by drainage. One has but to go to some parts of the Continent, where the largest amount of work of this kind has been done, to see the result of such outlay; to be astonished and delighted with the contrasts afforded in many districts, in which one will perceive at one side a wide tract of pure sand, on the other, divided by but an imaginary line, the finest of crops or the richest of pastures. Hence it is that so much of the outcry in favour of the reclamation of waste lands has arisen; but it must be remembered that before such results can be obtained, there must be in the sand, or the subsoil on which it lies, certain elements of fertility, without which nothing can be expected. But however small may be the proportion of such elements, fertility can, in process of time, be wrested, so to say, even from such sands. It is another question, however, altogether whether the efforts will pay. But supposing that the elements of fertility be in fair abundance, then the result is in such likely prospect that it will be worth while to attempt their reclamation. The chief elements of fertility required to make sands productive are the calcareous ones, and to these must be added moisture. Indeed, by irrigation with sewage manure alone, or even with pure water, the poorest of soils of this class may be made fertile. With the latter element calcareous constituents must be present however, or be added to it by mixing the soil with chalk. Sandy soils may also be brought into a state fit for cultivation by mixing them with marl, clay, or chalk, which gives a solidity to them, and enables them to retain what is given to them in the shape of manure. The following remarks have reference to pure sandy soils, in which few or none of the ordinary fertilizing constituents of soil are present, consisting chiefly of silica. The finer the sand the better the chances of success.

The first step to be taken in making a sand into a soil is to grow plants which have penetrating roots, which strike into the subsoil, in which generally the fertile elements exist. In Belgium, to which we have already alluded, the sandy tracts are planted here and there with bunches of twitch grass, the object being, in the first instance, to get the shifting sandboard into something like stability. The roots of these being reticulated, rapidly spread on all sides of the central bunches, and not only bind the soil together, but, as the upper parts in season decay, they fall, and, mixing with the upper surface, the first step towards the formation of a soil is made. The next "crop" put in is generally spurry, or *spergull* as it is called there, and this is dug or ploughed in, or allowed to decay at the end of the season. In due time higher classes of plants are grown, sainfoin being one, the roots of which go deeply down to the subsoil and draw upon its calcareous elements. This is either eaten off by sheep or mown, and the roots remaining in the soil tend still further to bind the mobile sandy particles together. But then the great secret of the speedy success with which the reclamation of such soils is secured, is the liberal use of liquid manure. Irrigation works, too, form an important part of the reclamation, and once these are fairly in operation cultivation proper follows with amazing celerity. The true principle, then, of the reclamation of sandy wastes, which grow nothing upon their surface naturally, is to form a soil by mixing, so to say, the sand with other materials which will support plant life; in other words, to form a soil. By the growing of twitch or couch grass, which in process of time decays and binds the shifting sand together, and then by gradually introducing other and a higher order of plants, as sainfoin, all those having penetrative roots, the process is continued till at last rich pasture grasses cover the once mobile sands. In some cases, sands produce naturally certain plants or shrubby growths; these show that there are elements in them favourable to their growth, and these plants, if burnt, will afford a supply of ashes which will be useful in forming a surface soil. Lime should then be added, and other plants will then be capable of being grown, and in process of time a vegetable covering will be formed on the surface. If this be pared, burned, and the ashes mixed with the surface, a further step will be taken. At the same time the contents of compost heaps, previously prepared, (of which the value for many other purposes is but too little known and availed of in farming), should be mixed and ploughed in with the surface soil, care being taken to have lime as a constituent of these, as in all well-formed compost heaps it is sure to be. If in a limestone district, the road scrapings will be a most valuable addition to the materials for mixing with the surface. If in the neighbourhood of the sea, seaweed should be collected, dried, and burned, and the ashes mixed with the soil; or the weeds may be added to the compost heaps. Oats or rye, or rye and vetches, may be then taken as first crops, after which the cropping will be according to the plan laid down. We have *already* alluded to the value of mixing such soils with *marl, clay,* or chalk.

Heathy and Light Sandy Soils and Commons Land.

In the reclamation of heathy sandy wastes or "commons land," on which there is often a fair, or perhaps, as is often the case, a free crop of rough undergrowth, the first step to be taken is the paring of the vegetable surface where it exists, the grubbing up of the undergrowth, and the burning of the whole so as to get a supply of ashes. These, with the contents of compost heaps and the processes last described, follow. A very notable and successful instance of the reclamation of sandy common land is that of Bagshot Heath, on the South-Western Railway. The upper soil met with on this celebrated common is a dark sand, with an underlying stratum of a ferruginous pan or crust of a most unpromising character; so much so, that unless this is well stirred so as to reach the subsoil of clay and sand underlying the pan, there can be no culture carried out. In mixing this subsoil with the upper sand, the quickest mode of rendering the sand productive is met with. The best known if not the most extensive system of reclamation carried out of this most unpromising land, is that adopted by Mr. Hewitt Davis, who has written an account of his proceedings. The preliminary operation was to free the upper surface from the pools of stagnant water which were here and there to be met with. This was done by widening and deepening the old ditches and making new ones, so as to enclose the land to be reclaimed. The land was then trench-ploughed from 14 to 16 inches, bringing up a portion of the clayey subsoil above named. Every available means were adopted to procure manure; the turf was burned to make ashes, sheds were built to provide accommodation for cattle and pigs, so as to supply solid and liquid manure. The land was then drained with tiles placed 4 feet deep, and at distances from 40 to 50 feet apart. The result of these operations, even three short years after they were commenced, was so satisfactory, that there is not the slightest doubt that similar lands throughout the kingdom, other things being equal, might be reclaimed to a certainty, so as to produce fair crops paying the work of reclamation. The following system of rotation has been recommended for such soils or lands. After the land has been well cleaned, broken up, and manured, the first crop to be taken is a root one, the second being also roots, grown as economically as possible; third, seeds with a cereal crop; fourth, the grass of the seeds after the corn crop is cleared to be grazed by sheep, which add wonderfully to the richness of the soil by their manure, as also to its consolidation by their feet. In the case of

Heavy and Poor Soils of Waste Lands.

The first step to be taken is drainage, as such soils are almost universally water-logged, so to say, cold, and very difficult to work. They vary greatly in quality. Some are so good, that after being drained efficiently they will, by careful, judicious cropping, rapidly repay the cost of working, and turn out excellent land; others, too, well known as "poor clay-land farms," are made to yield a paying produce only by expenditure of much capital, and patient waiting for time to do its work. After such soils are drained, the breaking up and getting them pulverized and open to the atmosphere is the next peration, after which the cropping commences with a first year's dead or naked fallow; this in the second year followed by spring fallows well limed, then sown with white mustard, to be ploughed in, and the land then seeded down with mixed grasses about the end of July. Third year, the grass from the seeds; this to be mown. Fourth year, seeds for grazing and top-dressed. Fifth, winter beans. Sixth, wheat artificially manured. For the richer clay soils the rotation should begin with roots, which are a good preparative for the succeeding cereal crops.

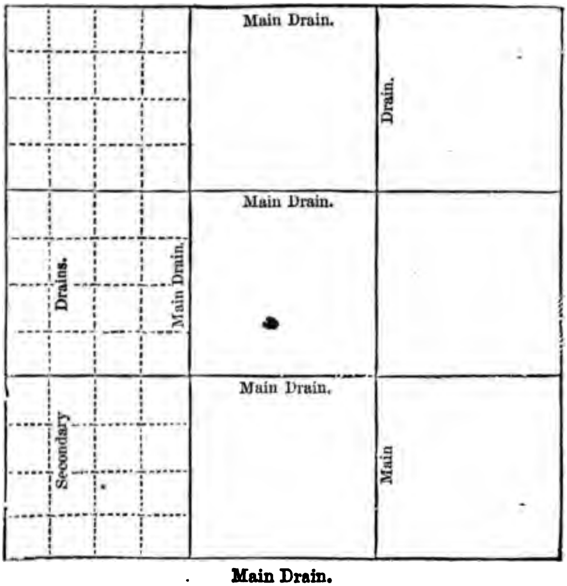
Where the waste lands are wet or marshy, the first point, it is needless to say, is the thorough draining of the whole. The most extensive works of reclamation of waste lands ever undertaken are those which were begun some time ago, and are still being carried on, upon the estate of the Duke of Sutherland in that county. Of these an excellent account, as interesting as it is practically useful, will be found by the reader in *The Field*, under date May 22, 1875. We may note, however, as the remarkable feature of the work, that the whole of it has been done by the power of steam—the breaking up of the soil, the ploughing, grubbing, tearing up the large boulders, stones, and the roots of trees, and removing the stones from the land, as well as grubbing or fairly wrenching out from the soil such trees as were necessary to be removed. The soil, varying from a shingle to a deep swampy moss, abounds in many places with huge boulders and large stones, which caused at first many breakages; but the Duke himself, and the Messrs. Fowler of Leeds, who supplied all the steam cultivating machinery, were equal to every emergency—and many a one turned up in the course of the work—till at last the apparatus is now in a thoroughly efficient condition. The steam power at work just now is upwards of 140 horse, and cost, with the implements (some of which were specially designed, a notable example being the marshland plough, with its disc sharp-edged wheel for riding over stones and avoiding breakages, and with its under-fluked hook coming after which pulls them out of the soil), over £14,000, no less a sum than £7,000 having been spent in perfecting details.

The following, for which we are indebted to a very able and exhaustive paper in the *Scotsman*, still more recently published than the article above noted, gives an account of the way in which the reclamation works are proceeded with :—

"If the ground be hard and strong, the huge cultivator with the anchor hook is sent over it, trenching the ground to a depth of 2 feet, and turning over the surface turf and soil without exposing the subsoil. Then the stones picked out are used in the formation of drains, which in this case are cut to a depth of from 3½ to 4 feet, while the larger boulders are taken to the sides of the fields for the purpose of building boundary dykes and for the formation of roads. In the case of mossy ground, drainage operations are first commenced —the drains being on an average 4 feet in depth, and constructed of tiles made at the Duke's tile-works at Brora, with wooden soles. Then the mossy ground is ploughed over, as in the other land. Ploughing over, the land is cleared of all stones and tree roots, and after that the heavy harrows are set to work to break up the clods. Next, the land is thoroughly dressed with lime, in the case of mossy ground to the extent of from 20 to 25 bolls per acre; while on stony hard land, about 15 bolls are scattered. The lime is then harrowed in, and eparations are made for a seed-bed. The first crop taken off is generally oats, then turnips, next oats and seeds, followed by two or three crops of grass, according to whether the five or six course rotation is adopted; and generally speaking it will be the latter. A certain amount of artificial manure is given, say about 3 cwt. dissolved bones to the acre, where a cereal crop is grown, or, in the case of grass, a couple of cwt. of superphosphates per acre, followed by a top dressing of 2 cwt. per acre of nitrate of soda. The farms being all intended to be on the old-fashioned system of infield and outfield, they are to be furnished with hill or improved pasture as well as arable. The hill pasture has been reclaimed by running the heavy harrow over it, then dressing it with lime, and next sowing it down with natural grasses. Three years ago only some 500 acres had been reclaimed, but the whole ground now subjected to cultivation, and which four years ago was comparatively valueless, is 2,024 acres. The mere conversion of the land from a bog to smiling grain fields is not all that has been accomplished, for commodious farm buildings have been erected, with all modern improvements in the out-houses in the way of cattle-sheds and courts and extensive barn-yards."

In various districts of Scotland and Ireland, the latter more especially, and in several of England, large tracts of boggy land are met with now lying in every sense of the term "waste" and unproductive. That all of these cannot be reclaimed is beyond a doubt, but it is equally so that there are thousands of acres of them which could. The following is a description of one successful method adopted in the reclamation of such apparently hopelessly unproductive soils, if tracts the largest proportion of the surface of which is water can *be so called.*

This last sentence indicates the very first operatio which must be taken in the work of their reclamation—drainage. The general mode of effecting this, wher the bog or moss does not present unusual difficultie from its great depth or large percentage of water, is t cut a series of drains varying in depth from 4 to 5 feet and so intersecting at right angles to each other, tha



they form a series of squares, a convenient size fo these being 100 yards in the side. These large o main squares are again to be cut up into smalle squares by a series of secondary drains, which, bein of less depth, fall into the main drains, the dispositio of the whole being somewhat as follows:—

In clay, or comparatively dry moss land, where it well consolidated, these drains may be cut to their full depth at once and the drain-tiles laid down; but where the moss is wet, which is generally the case, the process of draining and consequent consolidation of the land is a very slow one, usually occupying a period from two and a half to three and four years.

Subsequent operations vary according to circumstances. The following is an example out of many we could give, did space permit, of one method. Parts of the subsoil were of a bluish clay; in other parts the bog was so deep we could not find bottom, and were obliged to make one with small stones; then the pipes were laid on the top of the stones, and 4 inches of stones above the pipes, which made a permanent job. After draining, 6 acres of it were grafted and burned for winter vetches, which crop weighed in the month of June 12 tons per acre. They gave abundance of food for 40 cattle and 12 horses. The cattle were housed to eat off the vetches in time for a crop of Swedish turnips, which crop weighed 26 tons per acre. The vetches were top-dressed in the month of March with 2 cwt. of guano and 3 cwt. of salt per acre, mixed together, and sown in a wet day. The turnips were manured with 15 tons of farmyard manure and 2 cwt. of guano per acre. The remainder of the bog was ploughed with three horses abreast, and in the spring all prepared for turnips. Burned as much of the heath surface as possible, until the weather became unfavourable, and carted the remainder of the sods into large heaps, which made good top-dressing after the turnips were removed. Half of the turnips were carted home for fat cattle, and the other half were eaten off with sheep. In 1857 the bog was sown with oats with a *drilling* machine, 6 stones of seed per acre, and produced 12 barrels per acre. It was sown with grass seeds at the same time, which gives fine pasture for sheep after harvest. In 1858 it was top-dressed with 40 barrels of lime per acre, and again sown with oats, 6 stones of seed per acre, which produced 12 barrels per acre. The writer did not approve of taking two white crops in succession; but it was to get the bog subsoiled and levelled. There is no way so good as the four or five course shift; then the land is always in clean condition, and easily managed for a crop.

But if there be extensive tracts of land on the low-lying districts distinguished by their excess of water, there are some scarcely less extensive in the high-lying ones distinguished by its absence; we refer to the land in hilly districts, often named "benty waste," covered with a vegetation of hard, dry, withered yellow-looking innutritious grass, if it can so be called, which on the average is not worth a shilling an acre, if it be worth that. The following is an example of a mode of changing this worthless land into pasture, which, in this particular instance, may be valued, at the very least, as being worth twelve shillings the acre.

The soil operated upon is principally a moss some 4 inches deep, having a slight admixture of soil; the whole rests on a subsoil of hard till, and the geological formation is the great Silurian or greywacke, so dark in colour as closely to resemble trap rock, for which, indeed, it is often mistaken. The produce of this moss land is a coarse, rough grass, called "bent," so unpalatable in its usual condition as to be fit for the food of sheep only after the moor is burnt, and the consequent *first growth*, which is tender and young, springs up. *The first* operation is the "ploughing;" this, from the *roughness of* the rocky soil, is necessarily a slow process, and should be done, if possible, during a black frost. A feathered share or sock should be given to the plough, and ploughing down hill is recommended as the best. In early summer the portion of moss land thus ploughed should be limed at the rate of 60 cwt. per acre, and grass seeds sown and harrowed in. Rye-grass is alone used, but under the influence of the lime and the action of the atmosphere white clover and other natural grasses soon appear. Heather-covered land has been brought under cultivation by the same method, 20 per cent. more of lime being given.

Warping Land.

Land which can scarcely be called "waste," for it is of the richest and most fertile character, can be reclaimed in large tracts on the banks of sluggish, low-lying tidal rivers, of which the Humber, running past Hull in Yorkshire, is an example, by the process known as "warping." It is adopted with remarkable success on the Continent as well as in such places as are on the margin of the sea, the land reclaimed being there known as "polder," and so rich is it that crops have been known to be taken off some parts for forty years in succession without any manure being used during this long period. For a description of the method of "warping" we refer the reader to the Rudimentary Treatise in this series by Mr. Wiggins, entitled, "Embanking Lands from the Sea." Suffice it here to say that the general principle adopted is to choose some part favourable to the operation, as where there is a greater slowness of the river's flow or the absence of very strong currents, and there putting down at right angles, *or at other angles* more or less acute, wicker or basket-work like fences or stakes. The interstices between these gradually arrest the muddy particles suspended in the water flowing through them, and these, becoming deposited close to the wicker-work, gradually form a soil which the tide leaves drier and drier each succeeding year, and which, in process of time, gets so consolidated, that crops can be taken from it as already stated. This is the simplest system of warping, and is only adopted in localities favourable to the employment of such economical appliances. But in the "warping" of land on the large scale, the operations are much more complicated and costly, involving the erection of embankments, the cutting of the main drains and of the subsidiary drains, the formation of sluices, and the levelling in some cases of parts of the enclosed land. The land chosen must of course be below the level of high water, and be conveniently situated as regards locality, and for the formation of the enclosing embankment and the openings to the main drains. The water, which in warping operations is generally salt, but is often rather brackish if the tide flow high up the river, is let into the main drain at spring tides, and flowing from thence into the subsidiary ones, runs over their banks on to the land, depositing its silt or fine muddy particles on its surface, and which is generally divided into compartments. The surface of the enclosed land is warped by degrees, as one part gets covered other drains are formed leading the water farther on, till the whole enclosed area is warped. On the banks of some tidal rivers a species of natural warping is carried on through a long course of years. By the action of some particular current which is deflected in a certain course by causes not always easy to explain, silt or mud is deposited at some point of the bank, from which at the same time—probably and indeed generally caused in time by the current above alluded to—the tide or water has a tendency to recede. By the two processes thus aiding each other, the deposit is more rapid than it otherwise might be, and parts, sooner or later, appear above the level of the spring tides. On these, in time, a rough vegetation appears of aquatic plants, and thereafter comes a growth of roughish coarse grass, upon which, however, as access is gained to the newly-formed land, a few sheep nibble a few blades. This grazing of sheep naturally, by their manuring the soil, &c., causes grass of a superior kind to appear and consolidate the surface, till at last considerable stretches of solid land are formed, which in Essex and other parts go by the name of "saltings." These in time may require to be embanked to keep out high tides, but, as a rule, they lie outside of lands which have already been embanked, enclosed, and cultivated on an extensive scale.

Woody Land—Brushwood—Copsewood.

The "Disforesting Act" of 1853 brought into the market large tracts of "woody land," the surface of which was covered with the wretched remains of the once splendid forests of which they formed a part, but chiefly with a thick undergrowth of useless small timber, "brushwood, and copeswood." Several fine farms have been produced out of those waste lands, and the reader will find in vol. v. of our work entitled "Outlines of Modern Farming," at p. 190, a description of some of the methods adopted in reclaiming the land which formed them.

Reclaiming of Lands from Sea and from Tidal Rivers.

This is a very important department of the general system of the improvement and management of landed property, part of which is bounded by sea margins, or through which runs for some distance either a tidal river or a river of the ordinary class. That enormous tracts of land or soil are now lying waste and useless which might be bearing the richest of crops, or, if laid out in pasture fields, might be supporting large flocks and herds of sheep and cattle, is beyond any doubt. Indeed, it is only those who, like the writer of these pages, have had the opportunity to examine personally the districts in which these tracts are situated, that can form any conception of the mine of wealth which lies there. And when comparing them with similar tracts which have been reclaimed, and are now farm lands of by no means the lowest value, they can see that much as has been done in the way of wresting land from the shores of the sea or from the banks of rapidly running tidal rivers, comparatively nothing has been done to what may yet, and will in all probability, be done. But it is on the other side of the Channel where the greatest triumphs of man in this, perhaps the most useful, as it is assuredly one of the most satisfactory, of the labours of estate improvement, are to be met with. Here, at the best, but small areas comparatively have been brought under cultivation; there whole provinces may be truly said to have rewarded the labours and enriched the exchequers of the industrious populations; and it is there also that the most instructive examples are to be met with and *the most* practical lessons to be learned, as to the most rapid and economical way in which the work of reclamation is done, and, not the least important, that work preserved when once effectually performed.

Lands which can be reclaimed from the action of tidal waters may be divided into the following classes: first, those which are wholly under water at every tide-rise; second, those which are only wholly under water at spring tides, or tides which rise abnormally high, and of which part only is wholly submerged at each daily recurring tide; third, those lands which, from the peculiar action of the tidal currents at certain parts, have got gradually, but partially only, filled up with deposited matter brought there by the tidal water, or from the muddy water brought down from inland by surface drainage, or small rivers or streams, which flow into the sea through creeks and rivulets which they themselves, or in conjunction with the action of the tides, have formed, and which lands so formed are covered only on the occasion of very high tides. These remain, therefore, for periods of longer or shorter duration wholly dry, so that herbage, more or less luxuriant and thickly bottomed, covers the silted or deposited soil, affording, in many instances, fairly good "bites" for sheep and young cattle. Such lands are generally known as "saltings." (See paragraph on Warping, p. 213.)

All those classes of land which are capable of being reclaimed from the action of tidal waters are met with on the sea margin or on the banks of tidal rivers alike, and all seem, on a mere cursory inspection, likely to be reclaimed so readily and economically, that the work would form a good investment for such capital as might be laid out upon them. But there is no class of property improvement so delusive as this is, and none therefore, which requires to be gone about with so much forethought and prevision and professional skill aided by local knowledge. And these require to be exercised not so much in some cases as in others; for in some the circumstances of soil, and the nature of the beach and the character and recurrence of heavy dashing seas, in the case of sea margins, and of the banks and rapid currents in the case of tidal rivers, make the question of reclaiming or not reclaiming one of easy solution, as it is at once obvious that the work would not pay the cost of outlay, or rather yield a fair return for the same. It is in dubious cases—when, viewed from one point, all seems fair and easy work to be done, and from another the difficulties are very considerable—that the solution is not so easy. One thing, therefore, to be drawn from this is, that the work of reclaiming land from the action of tidal waters—which land, from every point of view, comes legitimately under the head of *waste land*—is one not to be gone lightly about in the happy-go-lucky style, but is one which requires to be carefully considered in all its bearings, one not quite the easy thing to do which a certain class of writers in the public press maintain it to be.

But if there be doubt as to the propriety in a pecuniary sense of reclaiming certain classes of tidal water-covered lands, there is one class not yet named about which there can be no doubt whatever. Those classes which we have already noted come, as we have seen, strictly under the name of waste lands, that is, lands which have been always waste, and have never, therefore, yielded anything to the labours of the cultivator. *But there is* a class of lands in such localities which, *being originally* true waste lands, have at some time, *either within* or beyond the memory of man, been reclaimed and brought under cultivation as crop-bearing or grass-bearing lands; but these have, after being thus used, been, through one cause or another—indifference, or carelessness, or the poverty of the proprietors—allowed to have their defensive works of embankments, &c., ruined, wholly or partially so; and have thus, through the tidal waters having once more access to them, relapsed into their original state of waste, or are rapidly and from year to year so relapsing.

In such cases the work of improvement to be done is more correctly named, perhaps, as that of *recovery* than of reclamation; but it is only those who have had occasion to examine localities either on sea margins or tidal rivers who can form any idea of the large acreage of land which will, in the course of a very short space of time, be wholly lost to man, through neglect, wilful or otherwise, of the works which are essential to prevent them from being subjected to the action of the waters. Here there is a wide field for the work of the improver, and one which becomes, from its utility as well as the comparative ease with which it can be done, and the small sum, compared with that required for new works, necessary to be employed, almost philanthropic in character. Certainly, if done, the work would confer a national benefit upon us.

Having now briefly explained the methods of enclosing land from the sea, a few sentences will suffice to indicate the methods generally employed to bring the land under cultivation. The soil of such lands is generally either clayey, sandy, or loamy; but in the first instance they are, so to say, super-saturated with salt, so that the first step to be taken is to reduce this to the point at which the soil will be capable of bearing cultivable *plants*. This is done by cutting and arranging a series of open channels or drains, dividing the surface of the enclosed land into convenient spaces for cropping or pasture. These drains all run into a larger drain or delph, which encloses the whole of the land taken in, and which serves the double purpose of preventing live stock from gaining access to the embankment outside—to which by treading they do great damage—and a channel for carrying off the collected waters of drainage from the enclosed land, as well as those from part of the interior or upland cultivated districts, and also the rainfall from the surface. These drainage waters, passing along the various subsidiary channels already named, gradually carry off the salt particles which drainage withdraws from the soil and thus freshens it up for culture. The outside delph is so arranged as to the level of its bottom in relation to the sluices which carry off the water to the sea outside, that there is always three feet of water at the least in it. The usual width of the delph at top is 10 feet, at bottom 5, and 5 deep.

The first vegetation which appears on the surface of the enclosed land is that named in connection with the "saltings" described in a previous paragraph. Where parts do not get covered with this, it will be advisable to sow them down with Dutch clover and rye seed, previously harrowing the surface. The sowing should be experimental at first, to see how the seeds suit the soil. It is scarcely necessary to say that the land before this, having been consolidated enough, has been grazed off in the first instance by sheep. The land thus treated becomes in about seven years, less or more, according to circumstances, solid enough to be cropped; and if the soil be heavy or clayey, a number of crops of wheat and beans may be taken, till after it becomes *partially* exhausted, when a regular rotation of fallow, oats, clover, wheat, and beans, will follow, and prepare the heavy soil for being laid down to permanent pasture, which will be the best-paying method. Where the soil is very heavy and tenacious, a good deal of working must be given to its surface to open it up and make it level as much as possible; then taking as a first crop rape, this followed by oats, beans, and wheat. The admixture of burnt clay and of lime or chalk rubbish is generally used in districts where it is plentiful. Land so prepared and treated will bear the above rotation for a succession of twenty years, but its benefits will be more apparent in the case of permanent pasture.

Where the soil is lighter, such as sandy clay or loamy clay, less chalk dressing—the first was ten cart-loads to the acre, at 10*s.* the cart—will be required. Where the soils are very light or sandy, no tillage cropping is required previous to being laid down to grass, as the salt is soon washed out of them, and from the first they can be sown with such grasses as the *Agrostis maritima*, or seaside fiorin, where the soil is so light as to be blown about and require fixing, or with Dutch clover, in cases where it is more solid. Rape is, however, often taken as the first crop on such light soils, or mustard-seed, the white being the best, as it does not take such a hold on the land as the brown; but, as a rule, it will be better to begin the permanent grass at once. In the silty loamy soils, before laying down to permanent grass, the rotation may be beans, oats, and wheat; in stiff clays, the rotation is oats, beans, wheat, beans, wheat, fallow bringing in the seventh year before the grass is laid down. If the work of culture be well done—by freshening the land gradually, draining and working the soil thoroughly, taking moderately heavy crops from it, all with a view to the ultimate permanent grass—lands thus reclaimed may be expected to be of high value for grazing purposes;—such as those in Sussex, named by Mr. Wiggins, worth £3 to £4 per acre rental, and capable of carrying a fattening beast of 130 stones—8 lbs. to the stone—per acre; or those of Kent, which carry six to eight large sheep per acre; or those of Lincolnshire, which have carried as many as ten sheep—40 lbs. per quarter, 14 lbs. of wool—per acre; thus showing what may be gained by reclaiming land from the sea or tidal river margin, which would otherwise have remained useless and almost wholly unproductive, save here and there patches of "saltings," with their coarse herbage.

In concluding our remarks on the general work of the farm as regards cultivation and land management, we deem it advisable to offer a sentence or two on the important subject of the *sowing of seed.* It is a matter of considerable surprise to many who, for the first time, have begun to study the subject, to find that so little, practically, is settled as regards the details of this most important work, and how little, apparently, is known with reference to its theory. No doubt those acquainted with the practical literature of the last score of years or thereabouts, have seen a great many paragraphs on thick sowing and thin sowing; but if all these were collected together it would be seen, to the surprise of many who may have thus "read the records," that the whole was very much of a repetition, like the farmer's orders to his man, who asked—and the brief story is apropos to the subject—how much seed he was to sow this time, replied, "Oh! the same over again." And the truth is that, as regards the science of sowing, we have made little or no advance. We have been talking and writing about it in a weary circle of very large dimensions, no doubt, but, like all circles, perpetually returning to the same point. We have, as yet, had the subject treated empirically, and when it will be so scientifically it is hard to say. Our Societies will not move in the matter, and to do justice to the work it demands cannot be fairly asked from any single individual. All honour, however, to those who have done what has been done with it, and in this the name of one (Mechi) honourable in the history of agriculture will come up to the minds of most who know what that history has been during the last twenty years.

Hitherto the subject has been discussed simply from two points of view, the thick and the thin systems of sowing; but, as we have above hinted at, what are the degrees of these which ought to be adopted has not yet been decided—that is, supposing the thin system is the right one, how thin has not yet been settled so as to meet the practical requirements of the farm or garden. We believe, at the same time, that experience and research would show that no one rule would apply to all cases; for it is a point too frequently forgot, that in dealing with the practice of agriculture we have to work with elements of an exceedingly uncertain and varying character: uncertain, inasmuch as we do not know what effect a certain soil will produce upon certain substances placed under its influence; varying, because we find that the results of one season are not those of another, even where every step of the process gone through and all the materials used are identical. Nothing, indeed, is so marked as these characteristics of farm practice, as all those know who are acquainted with it. Climate, also, and the characteristics of seasons, come into play, and introduce other elements of difficulty and uncertainty to deal with. We repeat, therefore, that an extended range of scientifically carried out experiments as to sowing would give us no one rule which would be applicable to all circumstances of soil, locality, and climate; but they would give us this great advantage —we should be able to hit upon a fair average rule for each particular circumstance or class of circumstances, and we should, moreover, also gain a knowledge of many facts which we are at present quite ignorant of, and which would lead, we incline to think, to much that would bear upon other points of farm practice, for all its details are more or less linked or connected together.

We have no hesitation in saying that one point would be made very clear, that thick sowing carried to the exremity to which it is carried in the great majority of cases is utterly wrong in theory as it is in practice. What little we do know shows us that this very thick sowing is not merely the throwing away of seed unnecessarily, but that it hinders the good and the healthy growth of the plants. It would be worth while for any one who doubts us, to look at a seed-bed, say that of cabbage, as generally treated, where the seed is put in by scores, where "fives," or "units" even, would be the correct thing to do; and after the plants are fairly up the lesson learned will be all the more striking if, from some cause or another, the seed has not all germinated, thus giving at certain points patches of thin plants with their results.

The condition of the soil in which the seed is deposited exercises also a very important influence upon the germination of the seed and the after healthy growth of the plants. To sow seed in a wet soil is literally throw*ing* a large proportion of it away, or to form what may be called a series of seed dung-heaps; for the fact is that under such circumstances the seed, as a rule, does not germinate, but rot. The soil should then be thoroughly drained, so as to be in good condition; that is, in a moistish or dampish state, but easily separated into a fine tilth or series of particles. Connected with, or indeed forming part of, the subject of sowing thick or thin is the distance which the seed should be sown at if in drills, which we may say is now the accepted way in which to sow seed, and another point is the quantity of seed in the drills. But, as before said, we know nothing definitely on these points, or indeed on the whole subject; we are at present but groping in the dark; we surely will come to the light some day in these times so boasted of as being very scientific. The following is a *résumé* of what may be called the average practice of sowing of seed for farm produce. The first figures after the name indicate the quantity, the second the distance apart in the drills (this is not given in all instances), and the third the general period or season of the year at which the seed is sown. *Wheat,* 5 to 7 pecks, sometimes as much as 8, per acre; 6 to 9 inches; winter, October and November; spring, up to April. *Barley,* 3 bushels per acre; 6 to 9 inches; March and April. *Oats,* 2½ to 3 bushels per acre; 6 to 9 inches; February and March. *Rye,* 3 to 4 bushels, broadcast sown generally; if in drills, 9 inches; autumnal sowing. *Flax,* if for seed (linseed of commerce), 1½ bushels per acre; if for fibre (manufacture of linen,) 2½ to 3½ bushels; 6 to 9 inches if in drills; spring, March and April. *Winter beans,* 2 bushels per acre; 18 to 24 inches in drills; October. *Spring beans,* 2 to 4 bushels per acre; 18 to 24 inches; February and March. *Pease,* 2 to 3 bushels in drills 4 to 6 broadcast; in drills 12 to 1 up to 20 inches; March and April for spring, and latter end of October for winter varieties. *Vetches* (for green food), 3 bushels per acre; 12 inches in drills; end of September and up to end of October for winter, March to June in spring; crops or sowings to be in succession during these periods. *Turnips,* 4 lbs. per acre, in drills; 18 inches between the drills; when singled out, 10 to 12 inches between the roots; from middle of May to end of June for swedes; for white turnips, June. *Mangold-wurtzel,* 4 to 7 lbs. per acre; 18 to 20 inches; middle of April; if dibbled, the holes 12 inches apart; if sown along the drills, the plants singled out to be the same distance apart. *Kohl rabi,* if drilled, 4 lbs. per acre; if sown to be singled and transplanted, 1 lb. to the acre; 27 inches between the drills; when singled out in the drills the plants to be 16 to 18 inches apart; if transplanted from seed-beds 24 inches apart. *Cabbage,* sown to transplant, 1 lb. to the acre; distance of drills 27 inches in light up to 42 to 48 inches in very heavy soils; distance between plants transplanted, 2 feet; March. *Carrots,* 6 to 8 lbs. per acre; 10 to 16 inches in drills; 8 to 12 inches between the singled plants; March and April. *Potatoes,* end of March beginning of April to plant the "sets;" width of drills 12 inches; distance between the sets 14. *Rye grass,* 2½, *Italian do.* 3 bushels to the acre; spring and autumn. *Clover,* 12 lbs. to the acre, *Trefolium incarnatum,* 24 lbs. *Sainfoin,* 4 bushels, sown down with a cereal crop. Clover is sown generally with the barley crop.

The Live Stock of the Farm.

Of the general work of the farm there is none which *yields in importance* to that connected with the management of stock, whether viewed as producers of meat or of manure. It will be necessary, therefore, to glance as briefly yet as completely as may be at its leading principles and points of practice.

And first, as to the breed of the stock to be reared for market. Whatever be the one chosen—and the choice will be dependent upon circumstances of locality, climate, and mode of farming adopted—if success be desired, the animals selected should be the best of their kind. It is quite unnecessary to dilate at all upon this point, for if the farmer be not already convinced of its supreme importance, and indeed its obviously common-sense value, nothing we might say could possibly change his views. There is one point which, however, even those who know that the best chances of success rest in the selection of the best breeds, are apt to overlook, and which, indeed, has only had of late the importance attached to it which it deserves from the ravages which disease has been making in home flocks and herds, by the importation, so to say, into farms of diseased or infected animals. The point we refer to is this, that the farmer, in place of going into open market to purchase, will find the plan in the long run infinitely preferable to breed his own stock. Commencing with animals of the best breeds, and by prudent and careful look out, he will find this not to be such an expensive proceeding as some make it out and indeed find it out to be. The animals which he rears he knows will be good and sound in constitution, and he will also save himself the chances of loss by bringing on to his farm animals which for anything he knows may be diseased. Of late what may be called a new phase of farming has sprung up, in which the farmer purchases in open market or at country fair his stock, young or in poor condition, and fattens them up for the market, either selling them himself or sending them to one of the many live-stock auction-marts so numerously spread all over the kingdom. This is not farming, in the highest and best sense of the term; it partakes too much of the trading system to be so, and is far removed from the true professional practice of breeding, rearing, and fattening stock—a practice which brings with it not merely the highest profit, because it has the elements of the highest security, but a pleasure which makes it one of the real attractions of a country life. It was, and is, the practice of those who have done so much to raise the reputation of British farmers as the first breeders of the finest stock in the market and which bring purchasers from all parts of the world ready to pay the highest prices. In a word, the practice enables the farmer to know what he is about, with what elements in his business he is dealing, so that he can with some certainty predicate the ultimate results. The trading system, on the contrary, is, from its very nature, uncertain, and no true business man willingly likes to deal with uncertainty. His business is to begin with the best materials to operate upon, do his best to make the most of those, and then sell them to the greatest advantage. These few sentences will not have been written in vain, nor the time in reading them thrown away, if they tend even in but slight degree to stop a practice which has been growing of late years at a too great rate, and one which we believe has been, and is, the means of introducing, and therefore spreading, disease where it would not otherwise exist, as well as lowering the hitherto high standard of British stock breeding, rearing, and feeding.

☛ *The stock*, then, being of the best with which the farmer is provided, his attention must be given to the way in which that can be best, most economically, and most quickly brought into that condition ready for sale, and which, when sold, will bring the highest price. In doing this, the exercise of the highest skill and the most prudent forethought is demanded in the arrangements for the shelter of the stock, the cultivation of the farm so as to raise produce for their keep, or in its purchase, and in the general care of the stock themselves, so that they be maintained in good health and condition, and thus yield the maximum return for the minimum of time, care, and food bestowed upon them.

Glancing briefly at these points, let us first consider the buildings in which the animals are to be housed. This department is one of the highest importance, for it is obvious that one may provide them the best food, and give it them not only with unstinted hand, but in the most judicious way, and yet if one keeps his stock in buildings so arranged and constructed that they are of necessity placed in conditions which will keep them low, depressed, and in an unhealthy condition, they cannot possibly pay, in the highest sense of the term. We, in another part of this volume, give some details as to the arrangement and construction of the necessary buildings; what we have now to concern ourselves with is what may be called their general management. The best buildings may be put down, but if they are not maintained in the best way loss is sure to be the result. The examinination of a large number of farm buildings throughout the country has impressed us very strongly with the conviction that farm servants require to be educated as to the value of order, cleanliness, and regularity; and further, that the masters do not insist so much and so sternly as they ought to do on the gre value of these, and that they must be carried out as part of their work. Where irregularity is, there is always, as a rule, a loss of time, and time is money. Now the work of the farm should be laid down so that every step, so to say, of it should follow in due order the preceding, and all conduce to one great end—the doing of as much work as possible in the least space of time, always, however, involving this great principle, that hurried work half done is not work done in the proper sense of the term. Some men, for example, in the cleaning out of the buildings and in the feeding of the stock, are always in a hurry; but they are always behind time with their work, and that work is generally badly done. We have known some men feed and clean twice the number of cattle that another man could do, and yet have time to spare, the difference arising from regularity in the one case and the reverse of it in the other. Now a word of advice from the master may often set the man who is irregular right, for it often happens that a man goes wrong, not from the want of will to do right, but from ignorance as to how to do it. Regularity in feeding is of the utmost importance to the well-being of the stock; they come soon to know the periods at which they should get their food, and if that be not supplied at those periods they get restless and excited, and all know how bad an effect that condition has upon them. The same remark applies, although in a different direction, to the keeping of the houses, the animals, and the vessels in which their food is prepared and given, thoroughly clean. The way in which these are kept in many instances is a disgrace to those connected with the farms. It would be well if those who are careless in such matters could *have some faint* conception even of the bad influence which uncleanliness has upon the health of the animals. Take, for example, the functions of the skin. If these are not allowed to have free exercise, the animal cannot possibly be in good health, at least cannot be got into and kept in the best "condition," as it is technically termed; and those functions cannot be exercised where the hide of the animal is covered here and there with hardened patches of dung, and the whole surface of the skin covered with dust and the accumulation of months of neglect. Much as the time might be grudged by some masters, and much as the labour would be grumbled at by the majority of men, we have no hesitation in saying that time and labour given every day to the careful and thorough wiping down with dry straw, followed by judicious curry-combing, would be amply repaid by the improved condition of the animals. And as much of the dirt which accumulates upon the hide or the coat of cattle is caused by the dirty condition of the stalls, &c., these should be kept scrupulously clean. The general, we may say the universal, custom of bedding with long straw is by no means the most economical which could be adopted; neither is it that which conduces most to the cleanliness of the stalls and the cattle. The plan of bedding on cut straw or chaff commends itself much more to what might be called common-sense notions, and, if once tried, will never be given up for the older plan of using long straw. The droppings, solid, of the animals can be at once removed when short straw or chaff is used, and the minimum quantity of these be at the same time lifted and removed; whereas, when long straw is used, as every one knows who has practical experience in the bedding of stock, in removing the droppings, the long straw has to be pulled out in a long straggling heap, and perhaps the animal is lying on part of it, so that it cannot be removed wholly, and the result is simply making the stall floor frequently dirtier than it was before. Then, again, there is another advantage in the use of short straw or chaff: the manure made from it is made quicker, and it is "short" from the very first. In view of the inconveniences of long straw for bedding, sawdust is now used by many feeders, and tanner's bark is recommended by some. The worst of the latter is the smell it possesses, and as to both, they possess this disadvantage, that they do not decompose very quickly in the manure heap.

If regularity in feeding and in cleaning be attended to, this will in large measure bring about the "order" upon which we have insisted in which everything about farm buildings should be kept. "A place for everything and everything in its place," is a motto for every farm building, and one the full spirit of which should be carried out. Some farmers have a set of "rules" for the work of the various departments—stables, cattle, horses, dung, &c.—printed and hung up, so that they can be read by all. The plan is a good one, but like many another good plans it is often broken through from want of firmness on the part of the foreman or master, or from lack of attention on the part of the latter. "A master's eyes are worth a hundred pair of hands," true in every establishment, is nowhere truer than on a farm. But where work is insisted upon to be done, the work should not be excessive. Farm work, even in its easiest departments, is hard work, and cannot be carried to excess without grievous pain and injury to the workpeople. On too many farms the hours of labour are far too long. We have before *us the rules* of one "model farm," in which the work to be done takes up fifteen hours each day. This for six days, with some hours' work on the Sunday, is labour against which we need not wonder that men strike. It is a penny wise and pound foolish system to over-work people; more paying work is got out of them when they have comparatively easy work to do than when the work is excessive. The true direction and management of labour is not the least important department of the farm economy, and is far less thought of as a rule than its importance demands. More money is lost by lack of attention than many have any idea of.

By breeding his own stock, as already alluded to, the farmer will be pretty certain that the animals will be healthy, and that he will be secure from disease, that is, so far at least as imported unhealthiness is concerned. And knowing his stock, so to say, from their infancy, and gradually watching their progress to maturity, he will be able to form a fair estimate of their peculiarities, and from thence of their value either as fattening cattle or as dairy cows. He will thus in process of time be in the possession of herds and flocks of farm stock in every way suited to the locality, climate, and other characteristics of his farm; and taking care to select the best animals, and always breeding from those, he may, should he care so to increase or extend his business, take the position of a breeder of first-class stock, than which nothing, as things at present go, is pecuniarily more satisfactory.

In selecting animals to breed from, no matter of what class or for what purpose intended, there is one point which should always be attended to and if possible secured; that is, "roominess," if the term may be allowed, and it may be so, for it exactly expresses what is meant—roominess, we say, in that part of the structure of the animal in which all the vital organs find their seat. This attribute will generally be attended with what is required—large capacious stomach, free expanded lungs, large heart and liver. These are what may be called the working parts of the living machine; and if they have room to work freely in, all the secretions and active functions will go on freely also and work harmoniously together. However excellent may be other "points" of the animal, if this roominess—shown by large round barrel, wide-expanded front or bosom—be awanting, the animal will not give the first results as a breeder of the best kinds. Another feature—and it is one which will be very easily known or perceived—indicating in a general way a good animal, is the uniformity of its outline. All sudden breaks in this are indications of defects, or, as the labourer graphically put it, all "hills and hollows are bad things in a beast." The various parts of the frame, indicated in them by the flesh which it carries, should in a good animal blend gently and imperceptibly into each other, so that it will be a difficult thing to point out where one begins and the other ends. Those two are what may be called the leading features in a beast, and should be the first things looked to in selecting those which are to be retained for breeding purposes. There are other points of excellence which should not be neglected, but as those are details—and, indeed, in many instances owe their origin to the above leading features, or are greatly influenced by them—they will be found fully explained elsewhere. We are at present dealing only with general features of management, or epitomising them for readier reference.

In selecting the breed, not only must the locality of the farm, its climate, &c., be considered, but the mode by which it is proposed to rear the animals must be considered, so that their peculiarities will fit in, so to say, with the system of rearing. Much cannot, need not, be here said upon this point; what its chief feature is is indicated sufficiently by one remark, namely, that it would be bad management to select for the quiet repose and confinement of the stall or box-feeding system animals such as the West Highland, or any of the upland breeds, which are naturally restless in their habits, and disposed to free roaming rather than to quiet restraint. Much of the good results of feeding depends upon the adaptation of its details to the habits and peculiarities of the animals to be fed. This may appear to be a small and unimportant point, but it is at least one of those little things which go far to make up the sum of the perfect success of a system.

These remarks apply generally to nearly the whole of the animals constituting or making up what is called the live stock of the farm, the object of the breeding and rearing of which is the production of meat, and, in the case of sheep, the double object of meat and wool—the only exception being the horse, which is obviously bred and reared for working, not for meat-producing purposes.

The details connected with the breeding, rearing, and feeding of the various classes of stock constitute a department which, from the number of points to be considered, render it one which of necessity involves the giving of much space, so much that a special volume is devoted to them in this series, to which the reader is here referred. All that the plan of the present volume admits of, is simply to glance at the leading points which should be alluded to, in order to derive the greatest amount of profit from the various animals, and so to manage them that they will contribute the maximum effect to the general improvement of the estate.

It is scarcely necessary to say, or rather it ought not to be necessary to say, that the buildings of the farm designed for the housing of the live stock should be designed so as to afford not only the maximum of health and comfort to the animals and of ease in working or attending upon them, but that their fittings and general construction should be of the highest order. The pastures devoted to the outdoor feeding of the stock should also be of the highest class, not only as regards the kind and condition of the grasses which they yield, but in their convenient setting-out, size, and proximity to the buildings. We have already pointed out the importance of a change of "bite," to secure which, attention must be paid to the laying-out of the pasture fields. To ensure a good supply of hay, the meadow land will also demand the best cares of the farmer. And in order to have a supply of green cut food, not merely to supplement or make up the deficiencies of other food in times of scarcity, when one or other of the usual crops may fail in quality or quantity, but to give a change of food, care should be taken to provide on the arable parts of the farm sufficient breadth of land for the cultivation of forage crops, such as rye, vetches, &c., &c. To provide for the store cattle, which, as we have elsewhere stated, perhaps tax the skill as they certainly do the patience of the farmer more than any other class of stock, as well as for the general stock, forethought will be demanded, as to the store of roots and of straw for autumn, winter, and spring *keep*. The quality of the water supplied to stock should also be regularly attended to, and when the animals are housed, the utmost degree of care requires to be exercised in the keeping of every part of the buildings scrupulously clean, the vessels in which food is supplied equally so, and not less—although this is too often neglected—in the bodily cleanliness of the animals themselves. A point of essential importance is the regularity with which the food is supplied to the animals; irregular feeding not only brings about and confirms a lazy, "happy-go-lucky" style of attending to the wants of the animals, inclusive of a loss of much valuable time on the part of the servants, but the animals themselves rapidly deteriorate under the system, which should never be, nor is, tolerated on a well-ordered farm-steading. On a subject so varied, and abounding in so many and such minute details of management, all of which are of vital importance, it is a matter of exceeding difficulty to treat it in a work like the present, where the limits of space are so very confined, even in the very briefest of brief fashions, so as to give hints as to what should be done and what ought to be avoided, but what we have given will, we trust, be useful, if in no other way than as "hinting at hints."

CHAPTER VI.

IMPROVEMENT OF EXHAUSTED OR NEGLECTED PROPERTY.

General Points to be considered in the Improvement of Property.

WHERE an estate has been allowed through a variety of circumstances—some of which will at once suggest themselves to the reader—to be thoroughly worked out, and to have nearly all its departments in a condition the very reverse of a well-managed property, it will be a fortunate circumstance for those who are afterwards to inherit it, by right of descent or by purchase, as the case may be, that "something should happen" which will permit of its falling into the hands of those who will be inclined to do justice to it, and have it brought up to the present standard of modern farming and estate management. Some of our readers new to the subject may be surprised to learn that in our country there should be any estates in the condition we have here hinted at; but to those whose duties take them much amongst farms, &c., &c., the statement will be no new thing, nor will it create surprise; indeed, a very eminent public personage, who knows the subject well, has stated that, taking the farms of Great Britain all round, by a higher style of cultivation and general management their productive powers could be increased fifty per cent. This, *however*, like such broad statements generally, must be taken with a reservation; but its main principle is correct; and it will indicate to the student that, considering the large number of estates and home farms splendidly managed and cultivated, the number of those in the opposite category, with a hint at which we opened this section, must be very great.

In commencing the work of improvement of an estate, the proprietor, if a wise man, will ascertain before taking any other steps how much money will be required to do justice to the improvement; and if he finds that he has not sufficient to apply this to the whole area of his estate, he will be wise in appropriating the amount he can spare to improving thoroughly a small part, rather than spend it by only half—or, perhaps, in less proportion than this—improving the whole. To nothing is the axiom, "If a thing is worth doing at all it is worth doing thoroughly well," so applicable as to the soil—an axiom too often forgot both by proprietors and farmers, and which largely accounts for that deterioration of estates now under consideration.

But in order to "be sure of the ground he is treading upon," the proprietor should be careful to see, first, what is necessary to be done to improve the estate thoroughly; and, secondly, that the estimate of the cost of doing this is a sound one. Any one, to use a popular expression, is supposed to be able to value a property, although he may not be considered at all as an authority on points connected with its improvement. Now in this, as in other things, the dearest and best advice which can be got at the first will be the cheapest at the end. There are many first-rate valuers in the kingdom who are also good practical farmers. From this class let the proprietor choose his adviser, and having made his choice, let him not interfere in the slighest degree with the work of the gentleman whom he has selected for the important work. This we are sure every right-minded proprietor will perceive is but only a fair course of conduct. The choice being left to himself, it is presumed that in making it he has satisfied himself as to the competency of the party selected. This is a fair presumption, and being so, it is in one sense paying but a poor compliment to himself should he afterwards interfere—an interference which can only be justified on the supposition that his choice has been defective. On the other hand, it is no less his interest than assuredly it is his highest duty, that the Valuer should do his very best, and spare no pains to give a thoroughly honest and conscientious report on the whole subject of the improvements he would recommend for the estate, with a carefully drawn-up estimate of their cost.

To do this even on a small estate involves no small amount of personal labour, anxious thought, and conscientious care; but where it is large, and its characteristics are varied and more or less valuable, to properly report upon it will involve the outlay of much time. It is but right that the proprietor should remember this, although it must be confessed he will be apt to forget or overlook it if he judges of the amount of time and labour necessary to do the work by the standard set by some who entitle themselves land valuers, and who deem their work done by a hasty scamper—perhaps done nearly all on horseback—along the roads and lanes and through the fields of the estate, followed up by a brief report and an estimate in "stump" sums. True inspection of an estate is a vastly different thing from this, and, *as stated* above, requires much time, and which, therefore, the proprietor should be glad to pay for. Indeed, the more fully details are given, and the more minute the particulars on all points, the more fully should he be satisfied with the work of the gentleman whom he may consider himself fortunate in having engaged to do it, and that he is getting his money's worth. It is difficult to over-estimate the value of such a report; for it will be useful for a long time, details as to prices, &c., only altering, but the principles upon which the improvements recommended are based, will remain for future reference.

Special Surveys.

After making a general, but yet a careful, survey of the estate as a whole, noting the particulars as detailed in the first section, the special survey will follow. Much of the value of this, and of the economy of time devoted, will depend upon the ability of the reporter or agricultural engineer, some having an intuitive gift or knack of hitting at once upon a method of taking the requisite observations, and of presenting them in such a way that the minimum of time and of knowledge to grasp the details will be demanded on the part of the proprietor, or his agent, to whom the report is presented; while others, again, in place of going in this direct style about the work, proceed in a roundabout method, and present their observations and recommendations in such a confused way, that it is a matter frequently of extreme difficulty to take in what is presented without much laborious examination and study. In this matter, as in everything else, and more especially when, as now, there are so many details to be noted and reported upon, "system" is everything.

In carrying out a systematic survey, the reporter will be greatly aided by carefully studying the plan of the estate as a whole, and comparing this with his notes taken on making the general survey, noticed in a previous paragraph. This plan the proprietor will, or should, have; but, failing this, or if it is not carefully plotted or mapped, and to a sufficiently large scale, the reporter can fall back upon the Ordnance maps, which are perfect marvels of minute delineation of every object on the estate, executed with the most painstaking care and in the highest style of engraving.

Following out the system, it will conduce much to the clearness which we have already alluded to, if the survey is made starting from a central point of the estate—which will be the "home farm"—working gradually round and outwards from this point till the outer boundary is reached. An examination of the map may probably show that a series of figures, so to say, of fairly defined and accurate form, may be described in imaginary lines, either as circles, rectangles, or squares, with, of course, breaks here and there. If this is the case, a series of "zones," so to call them, may be obtained, each of which will embrace so many farms. These being numbered, and the farms indicated in each zone by name, the survey and consequent report will be thus made capable of being examined, and read with the minimum of time and labour, and each farm, lettered and named, will be registered, so to call it, in such a way that it can be referred to at once.

The plan or system, then, being decided upon, the reporter will proceed to examine each farm, taking it first as a whole and then in detail as to each separate field. The points to be noted and reported upon will be those upon which we have written more or less fully in the preceding chapters—such as laying out of and form and dimensions of the fields, roads, fences, buildings, drainage, rotation of crops, soil, manuring, &c., &c. Upon all these the reporter will state concisely and clearly his opinion as to their condition, with such suggestions for their improvement as he may consider necessary, with estimates of the cost of these, allowing in the estimates a certain percentage, say 10 per cent., for contingencies which are likely to arise in carrying out the works. The acreage of all the farms ought to be given, and the conditions on which they are let, and the rental they bring in at the time of reporting stated, with such suggestions as to alterations in any one or both of those two latter points named. The condition of the buildings, the extent of their accommodation, the state of the roads, fences, gates, river banks, sea-walling, irrigation works, reservoirs, wells and ponds, &c., will then be most carefully examined and reported upon, with such alterations or improvements as suggest themselves concisely named, and an estimate in detail of the probable cost of those. The plantations, lime-quarries, sand-pits, marl or clay beds, &c., will next be taken up, and in like manner treated of in the report and estimate. The shootings and fishings of the estate will next be gone into, reported upon, and suggestions made by which the revenue from them may be increased. Having thus taken in mass and in detail those parts of the estate which, however exhausted or neglected, bring in directly revenue greater or less, as the case may be, and which will be alluded to and reported upon, the next duty of the engineer or valuer will be to take up those parts, if any, of the estate which are lying unproductive, carefully and minutely examining them in all their aspects and points, in order to ascertain whether by judicious management they can be made productive, and a source of increased and increasing revenue to the estate. Those parts, as the reader will no doubt conjecture, will be the waste lands of the estate, classed under the heads as given in various sections in a preceding chapter—the lands which lie on the sea margins, banks of tidal and inland rivers, bogs, marshes, and common lands. Should any part of the estate lie near a town the sewage of which waits for utilization, the reporter will carefully examine the *pros* and *cons* of the question as to whether it can be used with advantage for the irrigation of any part in the near vicinity of the outfall. In short, the reporter will be careful to note every point by which improvements can be carried out, so that the maximum of revenue will be returned to the proprietor for the minimum outlay of cost, and of the period of time at the expiry of which the invested capital will be returned or reclaimed.

From what we have said in this the concluding chapter and in the preceding chapter of our work, the limits of which have compelled us to write in briefest, baldest fashion, the student and reader will perceive that the management and improvement of landed property involve the exercise of a high degree of scientific and professional skill, and the possession of business tact, zeal, and energy of no common kind. That the application of these, on a scale much more extended than has yet been witnessed in the agricultural history of our country, would add largely to its productive capabilities, admits of no manner of doubt; nor would this be the less valuable to those who have the good fortune to be the possessors of landed property.

Although the improvement of the estate as a whole *be decided* upon, if, according to the report, the work required to be done is not concentrated chiefly at one part, but is spread over many places, it does not follow that the whole points are to be begun at once and finished right off. Apart from other circumstances, proprietors, however anxious to have their property improved, scarcely like to pay large sums for an extensive body of workmen during a short period; unlike the nabob in the story, who, standing at his front door and observing some of his departing guests waiting as if for the carriage to come up, called out lustily to his servants to "bring up some more carriages," every proprietor is not ready to call, "Put on a great many more men and get the work finished quickly." The work will be better done in detail, those parts being taken up the first which the report points out as being the most pressing, such as repairs to sea-walls, &c., &c., which threaten damage if not at once attended to, or some work which can best or only be done at a special season. And it will be as well, if possible, to arrange the work which has to be done in winter so that it be near the workmen's homes, and obviate their long walking in severe weather. Beginning at the centre, and gradually working out towards the boundary, each piece of work will be done well, and the great advantage will be obtained of having the gang of workmen always under the supervision of the same overseer. A good deal will be saved in time and money if this overseer be one capable of managing workmen well, and, if so, understanding the laying out of and the proceeding with the work, so that the minimum of hands will give the maximum of work. By attention to this we have seen the same work done with one-half the number of men previously employed where the principle was neglected or overlooked. The proper organization of working gangs is a great point to aim at. By thus taking up the improvements in detail they will be better done, and there will not be such a heavy drain upon the exchequer of the estate as would otherwise be the case if a different system were adopted.

INDEX.

Accommodation roads to farms, 4
Act, Agricultural Holdings, 79
Agricultural Holdings Act, 79
Allotment of waste lands to farms, 60
Allotments, 26
Alternate husbandry system, 177
Arrangement and construction of farm buildings, 97—106
Autumn cultivation, 174

Bank, river, works, 127
Bank, river, works, piling for, 131
Banks, muddy, river, protection of, 128
Boggy land, reclamation of, 209
Breeds of live stock, 227
Buildings of the farm, various points connected with their arrangement and construction, 97—106
Buildings of the farm, plans of, 102

Catch-water system of irrigation, 133
Cattle, pasturing of, 234
Cattle, selection of, to suit locality, 234
Choice of tenants, considerations affecting, 68
Classification of soils, 16—17
Clay soils, 192
Climate of the estate, 6
Collecting and storing up of water, importance of, 116
Compost heaps and farmyard manure, 179
Construction and arrangement of farm buildings, 97—106
Construction and laying out of roads, 84—93
Construction and setting out of reservoirs for water, various points connected with, 118
Construction of ponds, 111—114
Cottages of the labourer, 107—110
Crops, quantities of seed for various, 225
Crops, soils classified according to, 16
Cultivation, autumn, 174
Cultivation of land reclaimed from the sea and from tidal rivers, 220
Culture, deep, of the soil, 173

Deep culture of the soil, 173
Deep drainage, 171
Deep ploughing, 173
Delph, explanation of, 220
Different kinds of farming practised, 32
Drainage, 169
Drainage, deep 171
Drainage of irrigated lands, 139
Duke of Sutherland's property, reclamation works on, 207
Duties and position of the landlord, 62
Duties and position of the various parties on an estate, as agent, bailiff, tenants, and labourers, 66—74

Embankments for enclosed lands on sea margins, 125
Enclosed lands on sea margins, embankments for, 125

Enclosed lands on sea margins, best soils for, 122
Estate, general work of the, 83
Estate, lands of, character of the, 5
Estate, parties on the, position and duties of the various, as agent, bailiff, tenants, and labourers, 66—74
Estate, value of woods on, 6
Estate, water privileges of the, 6
Extent of small holdings, 39
Extent or size of farms, 19

Fallow working, 196
Fallows, working of, 196
Farm buildings, various points connected with the arrangement and construction of, 97—106
Farm buildings, plans of, 102
Farm house, the, 106
Farm leases, 74—78
Farming, different kinds of, practised, 32
Farms, accommodation roads to, 4
Farms, allotment of waste lands to, 60
Farms, extent or size of, 19
Farms, large and small, considerations connected therewith, 20—26
Farms, "led," 31
Farm, the "Home," and its management, 27
Farm, the live stock of the, 226
Farms, the most convenient size of, 52
Farmyard manure and compost heaps, 179
Features, local, of the land, flat, hilly, &c., 8.
Fence, "quickset," or hedge, setting out of, 163
Fences, in relation to form of fields, 157
Fences in relation to rivers, &c., 160
Fences, varieties of, 151
Fences, sunk, 166
Fields, fences in relation to form of, 157
Fields, ploughing of, 45
Fields, roads and streams affecting form of, 55
Fields, size and form of, 41—52
Fields, size of pasture, 54
Form and size of fields, 41—52
Form, best, for quickset hedges, 165
Form of fields, fences in relation to, 157
Form of fields, roads and streams affecting, 55
Fowler's system of deep ploughing, 173
Furrows, position of, 47

Game, lease, and tenant-right questions as affecting letting value of land, 10—11
Gates, 93—97
General work of the estate, 83
Grass lands, management of, 190

Heathy sandy wastes, reclamation of, 205
Heavy lands, rotation for, 197
Hedge or "quickset" fence, setting out of, 163
Hedges, "quickset," best form of, 165
Hilly land, irrigation on, 133
Holdings, Agricultural, Act, 79
Holdings, small, extent of, 39
"Home" farm, the, and its management, 27
Homestead," relation of roads, to, 59.
House, farm, the, 106
Husbandry, alternate, system, 177.

Improvement of neglected reclaimed land, 218
Improvement of property, general points to be considered in the, 238
Improvements in the property, modes of carrying out, 245
Improvement of the property, reports upon, 242
Irrigated lands, drainage of, 139
Irrigation, catch-water system of, 133
Irrigation on hilly land, 133

Irrigation, ridge and furrow system of, 135
Irrigation, soils suitable for, 137

Kinds of farming, different, practised, 32

Labourer, the, 82
Labourers' cottages, 107—110
Land, classes of, reclaimed from tidal rivers, 217
Land, cultivation of, reclaimed from the sea and from tidal rivers, 220
Land, letting value of, as affected by the game, lease, and tenant-right questions, 10—11
Land, local features of the, flat, hilly, &c., &c., 8
Land reclaimed, improvement of neglected, 218
Land, reclamation of, from the sea and from tidal rivers, 216
Land, warping of, 213
Landlord, position and duties of the, 62
Lands best adapted for formation of water reservoirs, 117
Lands, enclosed, embankments for, on sea margins, 125
Lands enclosed, on sea margins, best soil for, 122
Lands grass, management of, 190
Lands heavy, rotation for, 197
Lands irrigated, drainage of, 139
Lands of the estate, character of, 5
Lands waste, allotment of, to farms, 60
Lands waste, reclamation and cultivation of, 199.
Lands waste, reclamation of, 36
Large *v.* small farms, considerations connected therewith, 20—26
Laying out and construction of roads, 84—93.
Laying out of plantations, 145
Leases, farm, 74—78
"Led" farms, 31
Lime as a manurial agent, 183
Live stock, breeds of, 227
Live stock, management and feeding of, 230
Live stock of the farm, 226
Live stock, breeds of, 227
Live stock, points of, 233
Local features of the land, flat, hilly, &c., 8
Local peculiarities of the estate, 1
Locality, selection of cattle to suit, 234

Management of lime in improving the land, 183
Management of live stock, feeding, &c., 230
Management of mixed husbandry soils, 188
Management of the "Home" farm, 27
Manure, farmyard, and compost, heaps, 179
Manurial agent, lime as, 183
Markets, means of transit to, 3
Means of transit to markets, 3
Mixed husbandry soils, management of, 188
Mixing of soils, 186
Mode of carrying out improvements in the property, 245

Neglected reclaimed land, improvement of, 218

Officials on the estate, position and duties of the various, as agent, bailiff, tenants, and labourers, 66—74
Organization of workmen engaged in improving the property, 245

Pasture fields, size of, 54
Pasturing of cattle, 234
Peculiarities, local, of the estate, 1
Piling for river bank works, 131
Plans of farm buildings for different systems, 102
Plantations for shelter, 142
Plantations, importance and value of, 141
Plantations, laying out of, 145
Plantations, preparing the soil for, 149

Plantations, pruning of trees in, 154
Plantations, rotation in, 144
Plantations, thriving of trees in, 153
Plantations, soils for, 143
Planting of trees, 147
Ploughing, deep, 173
Ploughing of fields, 45
Points of live stock, 233
Points to be attended to in reporting on the improvement of the property, 242
Ponds, their position, and construction, 111—114
Poor and heavy soils, cultivation of, 206
Position and duties of the landlord, 62
Position and duties of the various parties on an estate, as agent, bailiff, tenants, and labourers, 66—74
Position of furrows, 47
Property, general points to be considered in the improvement of, 238
Property, improvement in, the modes of carrying out, 245
Property, improvement of the, special surveys preparatory to, 241
Property, improvement of the, reports upon, 242
Property, special surveys of the, preparatory to improvement, 241
Protection of muddy banks of rivers, 128
Pruning of trees in plantations, 154
Pulverisers of the soil, atmospheric influences as, 174

Qualifications of tenants, 69
"Quickset" hedges, best form of, 165
"Quickset" or hedge fence, setting out of, 163

Reclamation and cultivation of *boggy land*, 209
Reclamation and cultivation of woody land, brushwood, copsewood, 215
Reclamation and cultivation of heathy sandy wastes, 205
Reclamation and cultivation of heavy and poor soils, 206
Reclamation and cultivation of warping land, 213
Reclamation and cultivation of waste lands, 199
Reclamation and cultivation of pure sand, 202
Reclamation and cultivation of soils by river banks, 200
Reclamation and cultivation of soils by sea margins, 201
Reclamation of land from the sea and from tidal rivers, 216
Reclamation of waste lands, 36
Reclamation works on the Duke of Sutherland's property, 207
Reclaimed land from tidal rivers, classes of, 217
Repairs of farm buildings, 108—110
Reports upon the improvement of property, 242
Reservoirs for water, various points connected with the setting out and construction of, 118
Reservoirs water, lands best adapted for formation of, 117
Ridge and furrow system of irrigation, 135
Rights tenant, 79
River banks, reclaiming of land from, 200
River bank works, 127.
Rivers, &c., fences in relation to, 160
Rivers banks of muddy, protection of, 128
Rivers, tidal, reclaiming of land from, and from the sea, 216
Rivers, tidal, cultivation of land reclaimed from, and from the sea, 220
Rivers, tidal, classes of land reclaimed from, 217

Road accommodation, importance of, 4
Roads and streams affecting form of fields, 55
Roads, laying out and construction of, 84—93
Roads, relation of, to "Homestead," 59
Rotation in plantations, 144
Rotation for heavy lands, 197
Rotations, 177

Saltings, 220
Sand pure, reclaiming and cultivation of, 202
Sea margins, best soils for enclosed lands on, 122
Sea margins, embankments for enclosed lands on, 125
Sea, reclamation of land from the, and from tidal rivers, 216, 220
Seed, quantities of, for various crops, 225
Seed, sowing of, 223
Selection of cattle to suit locality, 234
Setting out and construction of reservoirs for water, various points connected with, 118
Shelter by plantations, 142
Size and form of fields, 41—52
Size of farms, the most convenient, 52
Size of pasture fields, 54
Size or extent of farms, 19
Small holdings, extent of, 39
Small *v.* large farms, considerations connected therewith, 20, 26
Soil, atmospheric influences as pulverisers of the, 174
Soil, deep culture of the, 173
Soil preparing the, for plantations, 149
Soils best, for enclosed lands on sea margins, 122
Soils and their varieties, 13
Soils, classification of, 16—17
Soils classified according to crops, 16
Soils for plantations, 143
Soils mixed husbandry, 188
Soils mixing of, 186
Soils reclamation and cultivation of boggy land, 207
Soils reclamation and cultivation of heathy sandy waste, 205
Soils reclamation and cultivation of heavy and poor, 206
Soils reclamation and cultivation of woody lands, brushwood, copsewood, 215
Soils reclamation and cultivation of warping, 213
Soils reclamation and cultivation of pure sand, 202
Soils reclamation and cultivation of, by river banks, 200
Soils reclamation and cultivation of, by sea margins, 201—216
Soils suitable for irrigation, 137
Sowing of seed, 223
Stock, live, of the farm, 226
Storing up and collecting of water, importance of, 116
Streams and roads affecting form of fields, 55
Subsoils characteristics of, 15
Sunk fences, 166
Supply sources of water, 115
Surveys special, of the property preparatory to the improvement of, 241
Sutherland Duke of, property, reclamation works on, 207

Tenant rights, 79
Tenants considerations affecting choice of, 68
Tenants qualifications of, 69
Thriving of trees in plantations, 153
Tidal rivers cultivation of land reclaimed from, and from the sea, 220
Tidal rivers reclaiming of land from, and from the sea, 216
Transit to markets, means of, 3.
Trees suitable for sheltering plantations, 143
Trees thriving of, in plantations, 153
Trees planting of, 147
Trees pruning of, in plantations, 154

Varieties of soils, 13

Warping land, 213
Waste lands, allotment of, to farms, 60
Waste lands, reclamation and cultivation of, 199
Waste lands, reclamation of, 36
Water, collecting and storing up, importance of, 116
Water privileges of the estate, 6
Water reservoirs, lands best adapted for formation of, 117
Water supply, sources of, 115
Woods, value of, on an estate, 6
Woody land, reclamation of, 215
Work, general, of the estate, 83
Working of fallows, 196
Workmen on property improvements, organization of, 245

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Plates 17 and 18. Outfall Sewer. Bermondsey Branch.—19, 20, 21, and 22.

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Outfall Sewer. Reservoir and Outlet. Plan and Details.—23. Outfall Sewer. Filth Hoist.—24. Sections of Sewers (North and South Sides).

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